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A TREATISE

ON

THE SCIENCE AND PRACTICE

OF

MIDWIFERY.

BY

W. S. PLAYFAIR, M.D., F.R.C.P.,

PROFESSOR OF OBSTETRIC MEDICINE IN KING'S COLLEGE; PHYSICIAN FOR THE DISEASES OF WOMEN AND CHILDREN TO KING'S COLLEGE HOSPITAL; EXAMINER IN MIDWIFERY TO THE UNIVERSITY OF LONDON; LATE EXAMINER IN MIDWIFERY TO THE ROYAL COLLEGE OF PHYSICIANS; AND VICE-PRESIDENT OF THE OBSTETRICAL SOCIETY OF LONDON.

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ARTHUR FARRE, M.D., F.R.S.,
PHYSICIAN-EXTRAORDINARY TO HER MAJESTY THE QUEEN,
PHYSICIAN-ACCOUCHEUR TO H. R. H. THE PRINCESS OF WALES, AND
TO H. I. AND R. H. THE DUCHESS OF EDINBURGH;

AND TO

WILLIAM OVEREND PRIESTLEY, M.D., F.R.C.P.,
PRESIDENT OF THE OBSTETRICAL SOCIETY OF LONDON,

MY PREDECESSORS IN THE CHAIR OF MIDWIFERY
AT KING'S COLLEGE,

I Dedicate this Work,

IN GRATEFUL ACKNOWLEDGMENT OF MANY KINDNESSES.

31 George Street, Hanover Square, 1876.

PREFACE.

THOSE who have studied the progress of midwifery know that there is no department of medicine in which more has been done of late years, and none in which modern views of practice differ more widely from those prevalent only a short time ago. The author's object has been to place in the hands of his readers an epitome of the science and practice of midwifery which embodies all recent advances. He is aware that on certain important points he has recommended practice which not long ago would have been considered heterodox in the extreme, and which even now will not meet with general approval. He has, however, the satisfaction of knowing that he has only done so after very deliberate reflection, and with the profound conviction that such changes are right, and that they will stand the test of experience. He has endeavored to dwell especially on the practical part of the subject, so as to make the work a useful guide in this most anxious and responsible branch of the profession. It is admitted by all that emergencies and difficulties arise more often in this than in any other branch of practice; and there is no part of the practitioner's work which requires more thorough knowledge or greater experience. It is, moreover, a lamentable fact that students generally leave their schools more ignorant of obstetrics than of any other subject. So long as the absurd regulations exist which oblige the lecturer on midwifery to attempt the impossible task of teaching obstetrics in a short three months' course—an absurdity which has over and over again been pointed out—such must of necessity be the case. This must be the author's excuse for dwelling on many topics at greater length than some will doubtless think their importance merits, since he desires to place in the hands of his students a work which may in some measure supply the inevitable defects of his lectures.

Many of the illustrations are copied from previous authors, while some are original. The following quotation from the preface to Tyler Smith's "Manual of Obstetrics" will explain why the source of the copied woodcuts has not been in each instance acknowledged: "When I began to publish, I determined to give the authority for every woodcut copied from other works; I soon found, however, that obstetric authors of all countries, from the time of Mauriceau downwards, had copied each other so freely without acknowledgment as to render it difficult or impossible to trace the originals."

The author has to express his acknowledgments to many friends for their kind assistance by the loan of illustrations and otherwise, and more especially to his colleague, Dr. Hayes, for his valuable aid in passing the work through the press.

31 George Street, Hanover Square.
March, 1876.

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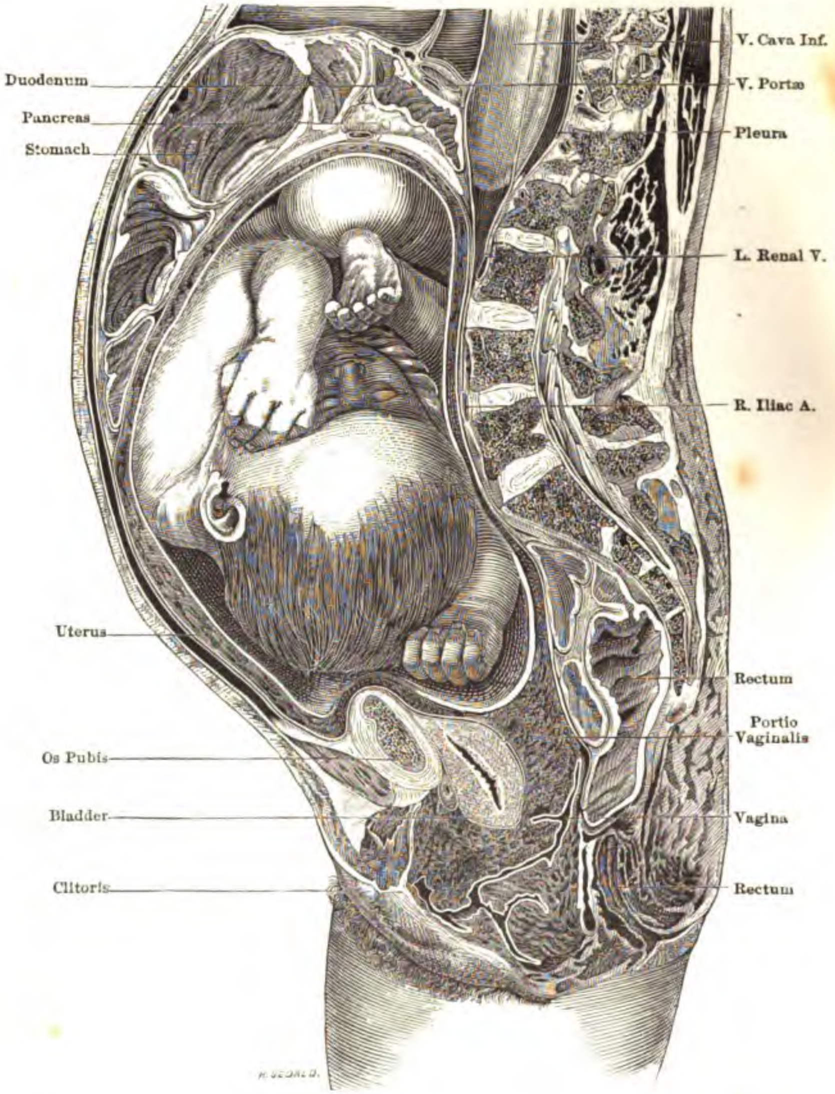
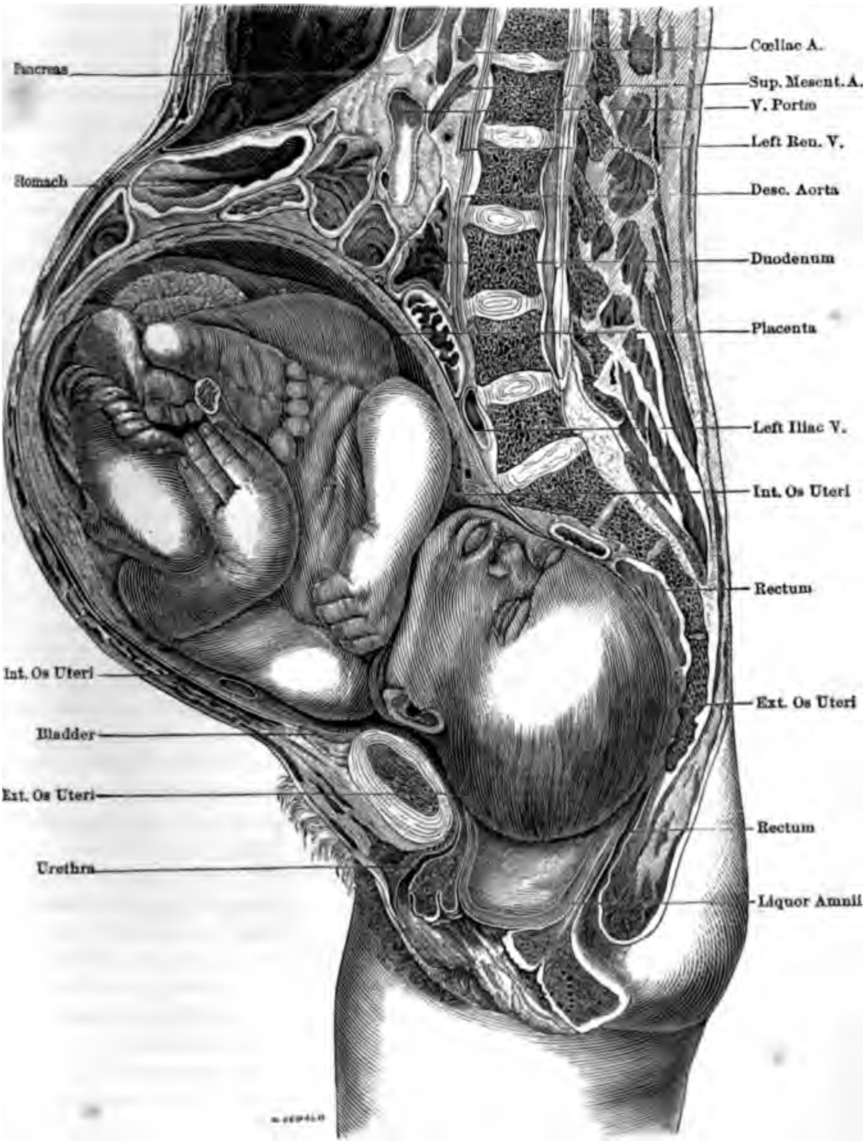
PLATE I.



SECTION OF A FROZEN BODY IN THE LAST MONTH OF PREGNANCY (AFTER BRAUNE), ILLUSTRATING THE RELATIONS OF THE UTERUS TO THE SURROUNDING PARTS, AND THE ATTITUDE OF THE FŒTUS, WHICH IS LYING IN THE SECOND CRANIAL POSITION.

PLATE II.



SECTION OF A FROZEN BODY AT THE TERMINATION OF THE FIRST STAGE OF LABOR (AFTER BRAUNE).
THE BAG OF MEMBRANES IS STILL UNBROKEN, THE CERVIX IS FULLY DILATED, AND
THE HEAD (IN THE SECOND POSITION) IS IN THE PELVIC CAVITY.

THE SCIENCE AND PRACTICE
OF
MIDWIFERY.

PART I.

ANATOMY AND PHYSIOLOGY OF THE ORGANS CONCERNED IN PARTURITION.

CHAPTER I.

ANATOMY OF THE PELVIS.

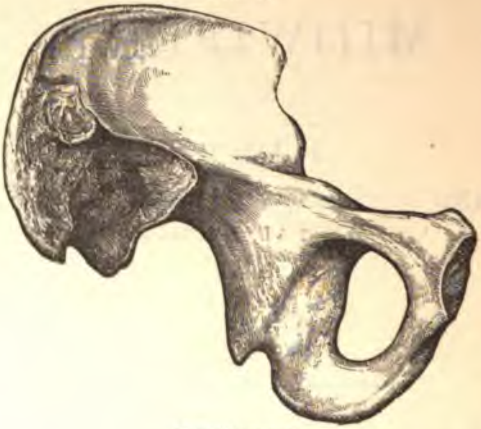
THE *pelvis* is the bony basin situated between the trunk and the lower extremities. To the obstetrician its study is of paramount importance, for it not only contains, in the unimpregnated state, all the organs connected with the function of reproduction, but through its canal the fœtus has to pass in the process of parturition. An accurate knowledge, therefore, of its anatomical formation may be said to be the very alphabet of obstetrics, without which no one can practise midwifery, either with satisfaction to himself or safety to his patient.

In a treatise on obstetrics, however, any detailed account of the purely descriptive anatomy of the pelvis would be out of place. A knowledge of that must be taken for granted, and it is only necessary to refer to those points which have a more or less direct bearing on the study of its obstetrical relations.

The *pelvis* is formed of four bones. On either side are the *ossa innominata*, which are joined together by the *sacrum*, to the inferior extremity of which is attached the *coccyx*, which is, in fact, its continuation.

The *os innominatum* (Fig. 1) is an irregularly shaped bone originally formed of three distinct portions, the *ilium*, the *ischium*, and the *pubes*, which remain separated from each other up to and beyond the period of puberty. They are united at the acetabulum by a Y-shaped cartilaginous junction, which does not, as a rule, become ossified until about the twentieth year. The consequence is that the pelvis, during the period of growth, is subject to the action of various mechanical influences which are brought to bear on it to a far greater extent than in adult life; and these, as we shall presently see, have an important effect in determining the form of the bones. The external surface and borders of the os innominatum are chiefly of obstetric interest from giving attachment to muscles, many of which have an important accessory influence on parturition, such as the muscles forming the abdominal wall which are attached to its crest, and those closing its outlet and forming the perinæum, which are attached to the tuberosity of the ischium. On the anterior and posterior extremities of the crest of the ilium, we note two prominences (the anterior and posterior spinous processes), which are points from which certain measurements are sometimes taken. The internal surface of the upper fan-shaped portion of the os innominatum gives attachment to the iliacus muscle, and contributes to the support of the abdominal contents; along with its fellow of the opposite side it forms the *false* pelvis. The false is separated from the true pelvis by the ilio-pectineal line, which, with the upper margin of the sacrum, forms the brim of the pelvis. This is of especial obstetric importance, as it is the first part of the pelvic canal proper through which the child passes, and that in which osseous deformities are most often met with. At one portion of the ilio-pectineal line, corresponding with the junction of the ilium and pubes, is situated a prominence, which is known as the ilio-pectineal eminence.

FIG. 1.



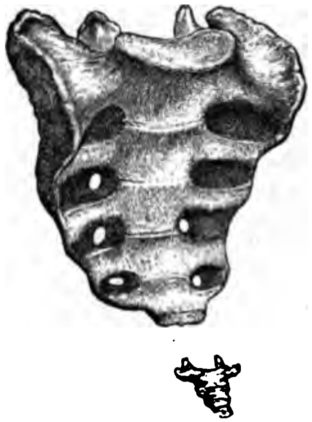
OS INNOMINATUM.

The internal smooth surface of the innominate bone below the linea ilio-pectinea forms the greater portion of the pelvis proper. In front, with the corresponding portions of the opposite bone, it forms the arch of the pubes, under which the head of the child passes in labor.

Behind this we observe the oval obturator foramen, and below that the tuberosity and spine of the ischium, the latter separating the great and lesser schiatici notches, and giving attachment to ligaments of importance. The rough articulating surface posteriorly, by which the junction with the sacrum is effected, may be noted, and above this the prominence to which the powerful ligaments joining the sacrum and os innominatum are attached.

The *sacrum* (Fig. 2) is a triangular and somewhat spongy bone, forming the continuation of the spinal column, and binding together the ossa innominata. It is originally composed of five separate portions, analogous to the vertebræ, which ossify and unite about the period of puberty, leaving on its internal surface four prominent ridges at the points of junction. The upper of these is sometimes so well marked as to be mistaken, on vaginal examination, for the promontory of the sacrum itself.

FIG. 2.



SACRUM AND COCCYX.

The base of the sacrum is about 4½ inches in width, and its sides rapidly approximate until they nearly meet at its apex, giving the whole bone a triangular or wedge shape. The anterior and posterior surfaces also approximate in the same way, so that the bone is much thicker at the base than at the apex. The sacrum, in the erect position of the body, is directed from above downwards and from before backwards. At its upper edge it is joined, the lumbo-sacral cartilage intervening, with the fifth lumbar vertebra. The point of juncture, called the *promontory of the sacrum*, is of great importance, as on its undue projection many deformities of the brim of the pelvis depend. The anterior surface of the bone is hollow, and forms the curve of the sacrum; more marked in some cases than in others. There is also more or less concavity from side to side. On it we observe four apertures on each side, the intervertebral foramina, giving exit to nerves. The posterior surface is convex, rough and irregular for the attachment of ligaments and muscles, and showing a ridge of vertical prominences corresponding to the spinous processes of the vertebræ.

The sacrum is generally described as forming a keystone to the arch constituted by the pelvic bones, and transmitting the weight of the body, in consequence of its wedge-like shape, in a direction which tends to thrust it downwards and backwards, as if separating the ossa innominata. Dr. Duncan,[1] however, has shown, from a very careful consideration of its mechanical relations, that it should rather be regarded as a strong transverse beam, curved on its anterior surface, the extremities of which are in contact with the corresponding articular surfaces of the ossa innominata. The weight of the body is thus transmitted to the extremities of the innominate bones, and through them to the acetabula and the femurs. (See Fig. 3.) There counter-pressure is felt, and the result is, as we shall subsequently see, an important modifying influence on the development and shape of the pelvis.

The *coccyx* (Fig. 2) is composed of four small separate bones, which eventually unite into one, but not until late in life. The uppermost of these articulates with the apex of the sacrum. On its posterior surface are two small cornua, which unite with corresponding points at the tip of the sacrum. The bones of the coccyx taper to a point. To it are attached various muscles which have the effect of imparting considerable mobility. During labor, also, it yields to the mechanical pressure of the presenting part, so as to increase the antero-posterior diameter of the pelvic outlet to the extent of an inch or more.

---

[1] Researches in Obstetrics, p. 67.

If, through disease or accident, as sometimes happens, the bones of the coccyx become prematurely ossified, the enlargement of the pelvic outlet during labor may be prevented, and considerable difficulty may thus arise. This is most apt to happen in aged primiparæ, or in women who have followed sedentary occupations; and not infrequently, under such circumstances, the bone fractures under the pressure to which it is subjected by the presenting part.

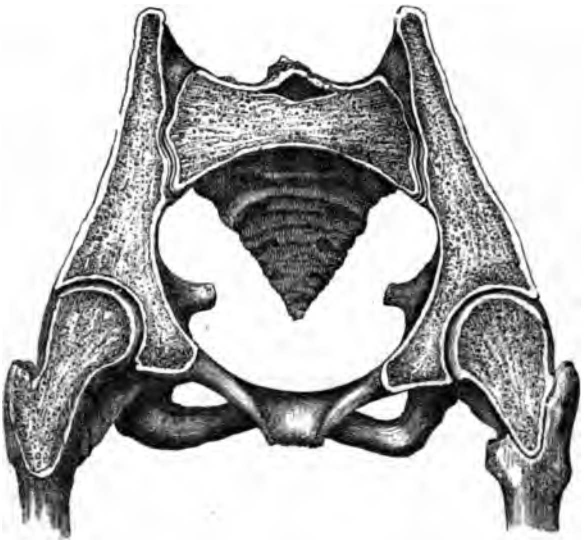
Pelvic Articulations.—The pelvic bones are firmly joined together by various articulations and ligaments. The latter are arranged so as to complete the canal through which the fœtus has to pass, and which is in great part formed by the bones. On its internal surface, where the absence of obstruction is of importance, they are everywhere smooth; while externally, where strength is the desideratum, they are arranged in larger masses, so as to unite the bones firmly together. The pelvic articulations have been generally described as symphyses or amphiarthrodia, a term which is properly applied to two articulating surfaces united by fibrous tissue in such a way as to prevent any sliding motion. It is certain, however, that this is not the case with the joints of the female pelvis during pregnancy and parturition. Lenoir found that in 22 females, between the ages of 18 and 35, there was a distinct sliding motion; and therefore the pelvic articulations are, strictly speaking, to be considered examples of the class of joints termed arthrodia.

Lumbo-sacral Joint.—The last lumbar vertebra is united to the sacrum by ligamentous union similar to that which joins the other vertebræ to each other. The intervening fibro-cartilage forms a disc, which is thicker in front than behind, and this, in connection with a similar peculiarity of the fifth lumbar vertebra, tends to increase the sloped position of the sacrum, and the angle which it forms with the vertebral column. It constitutes the most prominent portion of the promontory of the sacrum, and is the point on which the finger generally impinges in vaginal examinations. The anterior common vertebral ligament passes over the surface of the joints, and we also find the ligamenta sub-flava and the inter-spinous ligaments, as in the other vertebræ. The articular processes are joined together by a fibrous capsule, and there is also a peculiar ligament, the lumbo-sacral, extending from the transverse process of the vertebra on each side, and attaching itself to the sides of the sacrum and the sacro-iliac symphysis.

Ligaments of the Coccyx.—The sacrum is joined to the coccyx, and, in some cases at least, the separate bones of the coccyx to each other, by miniature cartilaginous discs like that separating the sacrum from the last lumbar vertebra. They are farther united by anterior and posterior common ligaments, the latter being much the thicker and more marked of the two. In the adult female a synovial membrane is found between the sacrum and coccyx, and it is supposed that this is formed under the influence of the movements of the two bones on each other.

Sacro-iliac Symphysis.—The opposing articular surfaces of the sacrum and ilium are each covered by cartilages, that of the sacrum being the thickest. These are firmly united, but in the female, according to Mr. Wood,[1] they are always more or less separated by an intervening synovial membrane. Posterior to these cartilaginous convex surfaces there are also strong interosseous ligaments, passing directly from bone to bone, filling up the interspace between them, and uniting them firmly. There are also accessory ligaments, such as the superior and anterior sacro-iliac, which are of secondary consequence. The *posterior sacro-iliac ligaments*, however, are of great obstetric importance. These are the very strong attachments which unite the rough surfaces on the posterior iliac tuberosities to the posterior and lateral surfaces of the sacrum. They pass obliquely downwards from the former points, and suspend, as it were, the sacrum from them. According to Duncan, the sacrum has nothing to prevent its being depressed by the weight of the body but these ligaments, and it is mainly through them that the weight of the body is transmitted to the sacro-cotyloid beams and the heads of the femurs.

FIG. 3.



SECTION OF PELVIS AND HEADS OF THIGH-BONES, SHOWING THE SUSPENSORY ACTION OF THE SACRO-ILIAC LIGAMENTS. (After Wood.)

The *sacro-ischiatic ligaments* are instrumental in completing the canal of the pelvis. The greater sacro-ischiatic ligament is attached by a broad base to the posterior spine of the ilium, and to the posterior surface of the ilium and coccyx. Its fibres unite into a thick cord, cross each other in an X-like manner, and again expand at their insertion into the tuberosity of the ischium. The lesser sacro-ischiatic ligament is also attached with the former to the back part of the sacrum and coccyx, its fibres passing to their much narrower insertion at the spine of the ischium, and converting the sacro-ischiatic notch into a complete foramen.

---

[1] Todd's Cyclopædia of Anatomy and Physiology, article "Pelvis," p. 123.

The *obturator* membrane is the fibrous aponeurosis that closes the large obturator foramen. Joulin[1] supposes that, along with the sacro-ischiatic ligaments, it may, by yielding somewhat to the pressure of the fœtal head, tend to lessen the contusion to which the soft parts would be subjected by being compressed between two entirely osseous surfaces.

Symphysis Pubis.—The junction of the pubic bones in front is effected by means of two oval plates of fibro-cartilage, attached to each articular surface by nipple-shaped projections, which fit into corresponding depressions in the bones. There is a greater separation between the bones in front than behind, where the numerous fibres of the cartilaginous plates intersect and unite the bones firmly together. At the upper and back part of the articulation there is an interspace between the cartilages, which is lined by a delicate membrane. In pregnancy this space often increases in size, so as to extend even to the front of the joint. The juncture is farther strengthened by four ligaments, the anterior, the posterior, the superior, and the sub-pubic ligaments. Of these, the latter is the largest, connecting together the pubic bones and forming the upper boundary of the pubic arch.

Movements of Pelvic Joints.—The close apposition of the bones of the pelvis might not unreasonably lead us to suppose that no movement took place between its component parts; and this is the opinion which is even yet held by many anatomists. It is tolerably certain, however, that even in the unimpregnated condition there is a certain amount of mobility present. Thus, Zaglas has pointed out[2] that in man there is a movement in an antero-posterior direction of the sacro-iliac joints, which has the effect, in certain positions of the body, of causing the sacrum to project downwards to the extent of about a line, thus narrowing the pelvic brim, tilting up the point of the bone, and thereby enlarging the outlet of the pelvis. This movement seems habitually brought into play in the act of straining during defecation.

During pregnancy in some of the lower animals there is a very marked movement of the pelvic articulations, which materially facilitates the process of parturition. These, in the case of the guinea-pig and cow, have been specially pointed out by Dr. Matthews Duncan.[3] In the former, during labor, the pelvic bones separate from each other to the extent of an inch or more. In the latter the movements are different, for the symphysis pubis is fixed by bony anchylosis, and is immovable; but the sacro-iliac joints become swollen during pregnancy, and extensive movements in an antero-posterior direction take place in them, which materially enlarge the pelvic canal during labor.

It is extremely probable that similar movements take place in women, both in the symphysis pubis and in the sacro-iliac joints, although to a less marked extent. These are particularly well described by Dr. Duncan. They seem to consist chiefly in an elevation and depression of the symphysis pubis, either by the ilia moving on the sacrum, or by the sacrum itself undergoing a forward movement on an imaginary transverse axis passing through it, thus lessening the pelvic brim to the extent of one or even two lines, and increasing, at the same time, the diameter of the outlet by tilting up the apex of the sacrum. These movements are only an exaggeration of those which Zaglas describes as occurring normally during defecation. The instinctive positions which the parturient woman assumes find an explanation in these observations. During the first stage of labor, when the head is passing through the brim, she sits, or stands, or walks about, and in these erect positions the symphysis pubis is depressed, and the brim of the pelvis enlarged to its utmost. As the head advances through the cavity of the pelvis, she can no longer maintain her erect position, and she lies down and bends her body forward, which has the effect of causing a nutatory motion of the sacrum, with corresponding tilting up of its apex and an enlargement of the outlet.

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[1] Traité d'Accouchements, p. 11.

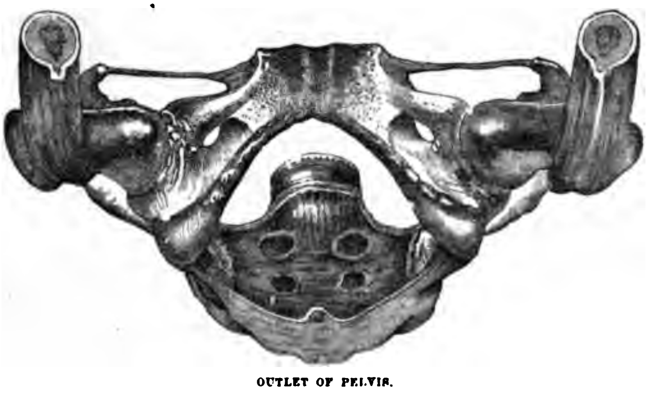
[2] Monthly Journal of Med. Science, Sept. 1851.

[3] Researches in Obstetrics, p. 19.

These movements during parturition are facilitated by the changes which are known to take place in the pelvic articulations during pregnancy. The ligaments and cartilages become swollen and softened, and the synovial membranes existing between the articulating surfaces become greatly augmented in size and distended with fluid. These changes act by forcing the bones apart, as the swelling of a sponge placed between them might do after it had imbibed moisture. The reality of these alterations receives a clinical illustration from those cases, which are far from uncommon, in which these changes are carried to an extreme extent, the power of progression being then materially interfered with for a considerable time after delivery.

The Pelvis as a Whole.—On looking at a pelvis as a whole, we are at once struck with its division into the true and false pelvis. The latter portion (all that is above the brim of the pelvis) is of comparatively little obstetric importance, except in giving attachments to the accessory

FIG. 4.

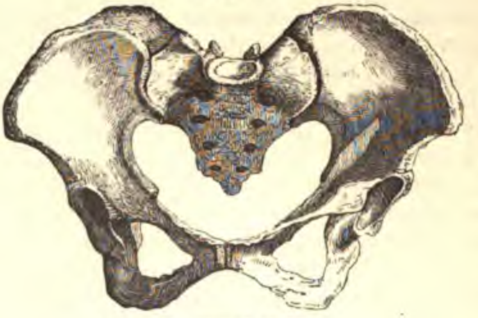


OUTLET OF PELVIS.

muscles of parturition, and need not be farther considered. The brim of the pelvis is a heart-shaped opening, bounded by the sacrum behind, the linea ilio-pectinea on either side, and the symphysis of the pubes in front. All below it forms the cavity, which is bounded by the hollow of the sacrum behind, by the inner surfaces of the innominate bones at the sides and in front, and by the posterior surface of the symphysis pubis. It is in this part of the pelvis that the changes in direction which the fœtal head undergoes in labor are imparted to it. The lower border of this canal, or pelvic outlet (Fig. 4), is lozenge-shaped, is bounded by the ischiatic tuberosities on either side, the top of the coccyx behind, and the under surface of the pubic symphysis in front. Posteriorly to the tuberosities of the ischium the boundaries of the outlet are completed by the sacro-ischiatic ligaments.

There is a very marked difference between the pelvis in the male and the female, and the peculiarities of the latter all tend to facilitate the process of parturition. In the female pelvis (Fig. 5) all the bones are lighter in structure, and have the points for muscular attachments much less developed. The iliac bones are more spread out; hence the greater breadth which is observed in the female figure, and the peculiar side-to-side movement which all women have in walking. The tuberosities of the ischium are lighter in structure and farther apart, and the rami of the pubes also converge at a much less acute angle. This greater breadth of the pubic arch gives one of the most easily appreciable points of contrast between the male and female pelvis; the pubic arch in the female forms an angle of from 90° to 100°, while in the male (Fig. 6) it averages from 70° to 75°. The obturator foramina are more triangular in shape.

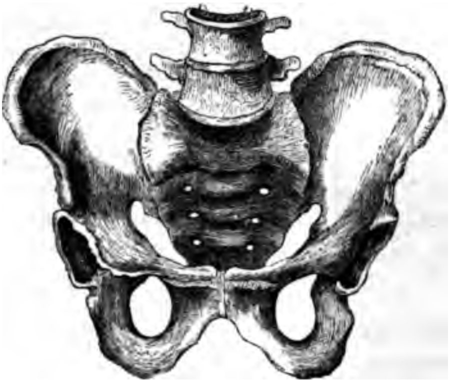
FIG. 5.



THE FEMALE PELVIS.

The whole cavity of the female pelvis is wider and less funnel-shaped than in the male, the symphysis pubis is not so deep, and, as the promontory of the sacrum does not project so much, the shape of the pelvic brim is more oval than heart-shaped. These differences between the male and female pelves are probably due to the presence of the female genital organs in the true pelvis, the growth of which increases its development in width. In proof of this, Schroeder states that in women with congenitally defective internal organs, and in women who have had both ovaries removed early in life, the pelvis has always more or less of the masculine type.

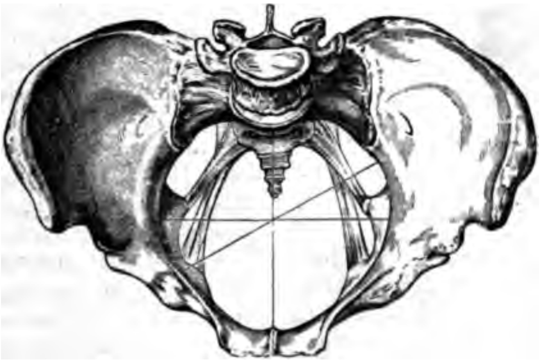
FIG 6.



THE MALE PELVIS.

Measurements of the Pelvis.—The measurements of the pelvis that are of most importance in an obstetric point of view are taken from various points directly opposite to each other, and are known as the *diameters* of the pelvis. Those of the true pelvis are the ones which it is especially important for us to fix in our memories, and it is customary to describe three diameters in works on obstetrics,—the antero-posterior or conjugate, the oblique, and the transverse,—although of course the measurements may be taken at any opposing points in the circumference of the bones. The *antero-posterior*, at the brim (Fig. 7), is taken from the upper part of the posterior surface of the symphysis pubis to the centre of the promontory of the sacrum; in the cavity from the centre of the symphysis pubis to a corresponding point in the body of the third piece of the sacrum; and at the outlet from the lower extremities of the symphysis pubis to the tip of the coccyx. [illegible]

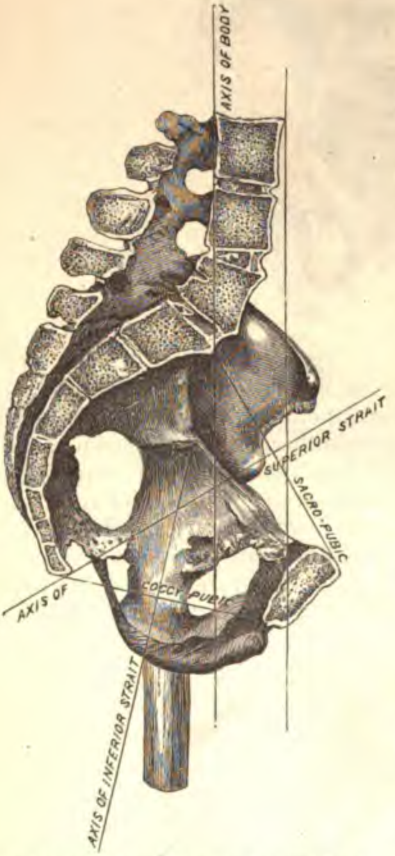
FIG. 7.



BRIM OF PELVIS, SHOWING ANTERO-POSTERIOR, OBLIQUE, AND CONJUGATE DIAMETERS.

at the brim, is taken from the sacro-iliac joint on either side to a point of the brim opposite the ilio-pectineal eminence (that starting from the right sacro-iliac joint being called the right oblique, that from the left the left oblique); in the cavity a similar measurement at the same level as the conjugate; while at the outlet an oblique diameter is not usually measured. The *transverse* is taken at the brim, from a point midway between the sacro-iliac joint and the ilio-pectineal eminence; in the cavity from corresponding points in the same plane as the conjugate and oblique diameters; and at the outlet from the centre of the inner border of one ischial tuberosity to the other. The exact measurements given by various writers differ considerably, and vary somewhat in different pelves. Taking the average of a large number, the following may be given as the standard measurements of the female pelvis:

Fig. 8.



TRANSVERSE SECTION OF PELVIS, SHOWING THE DIAMETERS.

	Antero-posterior. in.	Oblique. in.	Transverse. in.
Brim	4.25	4.8	5.2
Cavity	4.7	5.2	4.75
Outlet	5.0	—	4.2

It will be observed that the measurements of the corresponding diameters at different places vary greatly, and that while the transverse is longest at the brim, the oblique is longest in the cavity, and the antero-posterior at the outlet. It will be subsequently seen that this fact is of great practical importance in studying the mechanism of delivery, and that the head in its descent through the pelvis alters its position in such a way as to adapt itself to the largest diameter of the pelvis, for as it passes through the cavity it lies in its oblique diameter, and then rotates so as to be expelled in the antero-posterior diameter of the outlet.

In thinking of these measurements of the pelvis, we must not forget that they are taken in the dried bones, and that they are considerably modified during life by the soft parts. This is especially the case at the brim, where the projection of the psoas and iliacus muscles lessens the transverse diameter about half an inch, while the antero-posterior diameter of the brim, and all the diameters of the cavity, are lessened by a quarter of an inch. The right oblique diameter of the brim is, even in the dried pelvis, said to be, on an average, slightly longer than the left, probably on account of the increased development of that side of the pelvis from the greater use made of the right leg; but in addition to this the left oblique diameter is somewhat lessened during life by the presence of the rectum on that side. The advantage gained by the comparatively frequent passage of the head through the pelvis in the former diameter is thus explained.

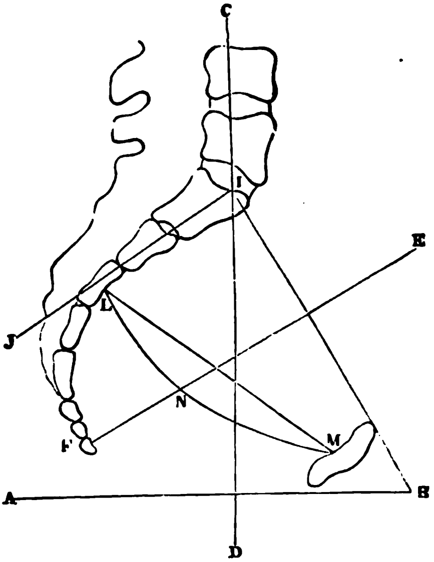
There are one or two other measurements of the true pelvis which are sometimes given, but which are of secondary importance. One of these is that between the promontory of the sacrum and a point immediately above the cotyloid cavity, the sacro-cotyloid diameter, averaging from 3.4 to 3.5 inches. Another is that between the centre of the lower margin of the symphysis pubis and the promontory of the sacrum, called by Wood the lower or inclined conjugate diameter, which averages half an inch more than the antero-posterior diameter of the brim. These measurements are chiefly of importance in relation to certain pelvic deformities.

External Measurements.—The external measurements of the pelvis are of no real consequence in normal parturition, but they may help us, in certain cases, to estimate the existence and amount of deformities. Those which are generally given are:—between the anterior-superior iliac spines, 10 inches; between the central points of the crest of the ilium, 10½ inches; between the spinous process of the last lumbar vertebra and the upper part of the symphysis pubis (external conjugate), 7 inches.

Planes of the Pelvis.—By the planes of the pelvis we mean imaginary levels at any portion of its circumference. If we were to cut out a piece of cardboard so as to fit the pelvic cavity, and place it either at the brim or elsewhere, it would represent the pelvic plane at that particular point; and it is obvious that we may conceive as many planes as we desire. Observation of the angle which the pelvic planes at any given point form with the horizon proves the great obliquity with which the pelvis is placed in regard to the spinal column. Thus, the angle A B I (Fig. 9) represents the inclination to the horizon of the plane of the pelvic brim I B, and is estimated to be about 60°, while the angle which the same plane forms with the vertebral column itself is about 150°. The plane of the outlet forms, with the coccyx in its usual position, an angle with the horizon of about 11°, but which varies greatly with the movements of the tip of the coccyx, and the degree to which it is pushed back during parturition. These figures must only be taken as giving an approximative idea of the inclination of the pelvis to the spinal column, and it must be remembered that the degree of inclination varies considerably in the same female at different times, in accordance with the position of the body. During pregnancy especially, the obliquity of the brim is lessened by the patient throwing herself backwards in order to support more easily the weight of the gravid uterus. The height of the promontory of the sacrum above the upper margin of the symphysis pubis is on an average about 3¾ inches, and a line passing horizontally backwards from the latter

point would impinge on the junction of the second and the third coccygeal bones.

FIG. 9.



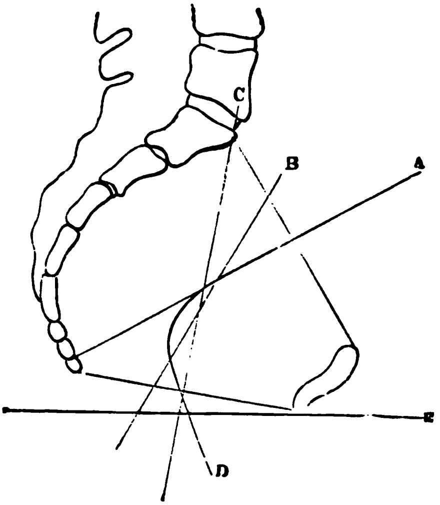
PLANES OF THE PELVIS WITH HORIZON.

A B. Horizon.
C D. Vertical line.
A B I. Angle of inclination of pelvis to horizon, equal to 60°.
B I C. Angle of inclination of pelvis to spinal column, equal to 150°.
C I J. Angle of inclination of sacrum to spinal column, equal to 130°.
E F. Axis of pelvic inlet.
L M. Mid plane in the middle line.
N. Lowest point of mid plane at spine of ischium.

Axes of the Parturient Canal.—By the axis of the pelvis we mean an imaginary line which indicates the direction which the fœtus takes during its expulsion. The axis of the brim (Fig. 10) is a line drawn perpendicular to its plane, which would extend from the umbilicus to about the apex of the coccyx; the axis of the outlet of the bony pelvis intersects this, and extends from the centre of the promontory of the sacrum to midway between the tuberosities of the ischia. The axis of the entire pelvic canal is represented by the sum of the axes of an indefinite number of planes at different levels of the pelvic cavity, and when these are united they form an irregular parabolic line, as represented in the accompanying diagram (Fig. 10, A D).

It must be borne in mind, however, that it is not the axis of the bony pelvis alone that is of importance in obstetrics. We must always, in considering this subject, remember that the general axis of the parturient canal (Fig. 11) also involves that of the uterine cavity above, and of the soft parts below. These are variable in direction according to circumstances; and it is only the axis of that portion of the parturient canal extending between the plane of the pelvic brim and a plane between the lower edge of the pubic symphysis and the base of the coccyx that is fixed. The axis of the lower parts of the canal will vary according to the amount of distension to which the perineum is subjected

FIG. 10.

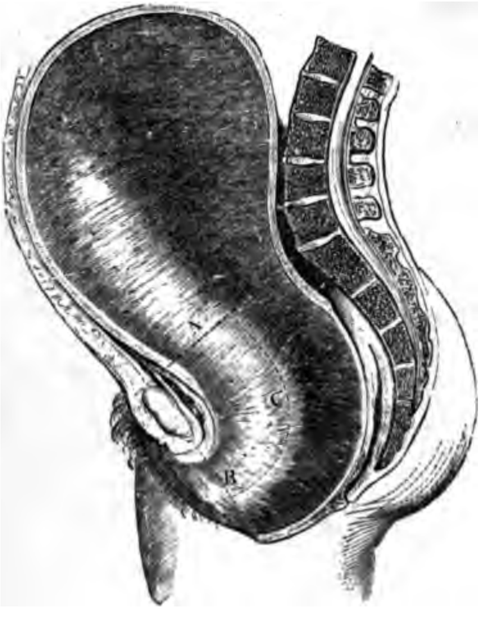


AXES OF THE PELVIS.

A. Axis of superior plane. B. Axis of mid plane. C. Axis of inferior plane.
D. Axis of canal. E. Horizon.

during labor; but when this is stretched to its utmost, just before the expulsion of the head, the axis of the plane between the edge of the distended perinæum and the lower border of the symphysis would look

FIG. 11.

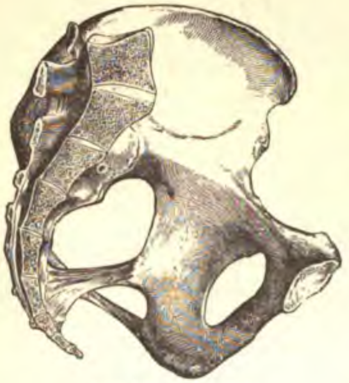


REPRESENTING GENERAL AXIS OF PARTURIENT CANAL, INCLUDING THE UTERINE CAVITY AND SOFT PARTS.

nearly directly forwards. The axis of the uterine cavity generally corresponds with that of the pelvic brim, but this may be much altered by abnormal position of the uterus, such as anteversion from laxity of the abdominal walls. The fœtus, under such circumstances, would not enter the brim in its proper axis, and difficulty in the labor would thus be caused. A knowledge of the general direction of the parturient canal is of great importance in practical midwifery in guiding us to the introduction of the hand or instrument in obstetric operations, and in showing us how to obviate difficulties arising from such accidental deviations of the uterus as have been just alluded to.

Cavity of the Pelvis.—The arrangements of the bones in the interior of the pelvic canal (Fig. 12) are important in relation to the theory of the mechanism of delivery. A line passing between the spine of the ischium and the ilio-pectineal eminence divides the inner surface of the ischial bone into two smooth plane surfaces, which have received the name of the planes of the ischium. Two other planes are formed by the inner surfaces of the pubic bones in front and by the upper portion of the sacrum behind, both having a direction downwards and backwards. In studying the mechanism of delivery, it will be seen that many obstetricians attribute to these planes, in conjunction with the spine of the ischium, a very important influence in effecting rotation of the fœtal head from the oblique to the antero-posterior diameter of the pelvis.

FIG. 12.

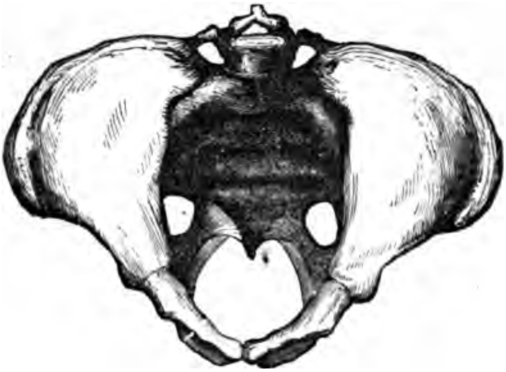


SIDE VIEW OF PELVIS.

Development of the Pelvis.—The peculiarities of the pelvis during infancy and childhood are of interest as leading us to a knowledge of the manner in which the form observed during adult life is impressed upon it. The sacrum in the pelvis of the child (Fig. 13) is less developed transversely, and is much straighter, instead of being deeply curved as in the adult. The pubes is also much shorter from side to side, and the pubic arch is an acute angle. The result of this narrowness of both the pubes and sacrum is that the transverse diameter of the pelvic brim is shorter rather than longer than the antero-posterior. The sides of the pelvis have a tendency to parallelism, as well as the antero-posterior walls, and this is stated by Wood to be a peculiar characteristic of the infantile pelvis. The iliac bones are not spread out as in adult life, so that the centres of the crests of the ilium are not more distant from each other than the anterior superior spines. The cavity of the true pelvis is small, the tuberosities of the ischia are proportionately nearer to each other than they afterwards become, and the pelvic viscera are consequently crowded up into the abdominal cavity, which is, for this reason, much more prominent in children than in adults. The bones are soft and semi-cartilaginous until after the period of puberty, and yield readily to the mechanical influences to which they are subjected, and the three divisions of the innominate bone remain separate until about the twentieth year.

As growth goes on, the transverse development of the sacrum increases, and the pelvis begins to assume more and more of the adult shape. The mere anatomical development of the bones, however, is not sufficient to account for the change in the shape of the pelvis, and it has been well shown by Duncan that this is chiefly produced by the pressure to which the bones are subjected during early life. The iliac bones are subject to two principal and opposing forces. One of these is the weight of the body above, which acts upon the sacral extremity of the iliac beam through the strong posterior sacro-iliac ligaments, and this vertical pressure tends to throw the lower or acetabular ends of the sacro-cotyloid beams outwards. This outward displacement, however, is resisted partly by the junction between the two acetabular ends by the front of the pelvis, but chiefly by the opposing force, which is the upward pressure of the lower extremities through the femurs. The result of these two counteracting forces is that the still soft bones bend near their junction with the sacrum, and thus the greater transverse development of the pelvic brim characteristic of adult life is established. In treating of pelvic deformities it will be seen that the same force applied to diseased and softened bones explains the peculiarities of form that they assume.

FIG 13.



PELVIS OF A CHILD.

Pelvis in Different Races.—The researches that have been made on the differences of the pelvis in different races prove that these are not so great as might have been expected. Joulin pointed out that in all human pelves the transverse diameter was actually larger than the antero-posterior, while the reverse was the case in all the lower animals, even in the highest simiæ. This observation has been more recently confirmed by Von Franque,[1] who has made careful measurements of the pelvis in various races. In the pelvis of the gorilla the oval form of the brim, resulting from the increased length of the conjugate diameter, was very marked. In certain races there is so far a tendency to animality of type, that the difference between the transverse and conjugate diameters is much less than in European women; but these changes are not sufficiently marked to enable us to refer any given pelvis to a particular race. Von Franque makes the general observation that the size of the pelvis increases from south to north, but that the conjugate diameter increases in proportion to the transverse in southern races.

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[1] Scanzoni's Beiträge, 1867.

In closing the description of the pelvis, the attention of the student must be directed to the muscular and other structures which cover it. It has already been pointed out that the measurements of the pelvic diameters are considerably lessened by the soft parts, which have also a considerable influence on parturition in other ways. Thus, we have attached to the crests of the ilium the strong muscles which not only support the enlarged uterus during pregnancy, but are powerful accessory muscles in labor; in the pelvic cavity we have the obturator and pyriformis muscles lining it on either side, along with the pelvic cellular tissue and fasciæ, the rectum and bladder, and the vessels and nerves, the pressure on which latter often gives rise to cramps and pains during pregnancy and labor; while below the outlet of the pelvis is closed, and its direction altered from backwards to forwards by the numerous muscles forming the floor of the pelvis and perinæum.

CHAPTER II.

THE FEMALE GENERATIVE ORGANS.

THE reproductive organs in the female are conveniently divided, according to their functions, into:—1, *The external or copulative organs*, which are chiefly concerned in the act of insemination, and which are only of secondary importance in parturition. They include all the organs situated externally, which together form the vulva; and the vagina, which is placed internally and forms the canal of communication between the uterus and the vulva. 2, *The internal or formative organs*, including the ovaries, which are the most important of all, as those in which the ovum is formed; the Fallopian tubes, through which the ovum is carried to the uterus; and the uterus itself, in which the impregnated ovum is lodged and developed.

1. The external organs consist of:

The *mons veneris*, a cushion of adipose and fibrous tissue which forms a rounded projection at the upper part of the vulva, being in relation with the lower part of the hypogastric region above, from which it is often separated by a furrow, and continuous below with the labia majora on either side. It lies over the symphysis and horizontal rami of the pubes. After puberty it is covered with hair. On its integument are found the openings of numerous sweat and sebaceous glands.

The *labia majora* form two symmetrical sides to the longitudinal aperture of the vulva. They have two surfaces, one external, of ordinary integument, covered with hair, and another internal, of smooth mucous membrane, in apposition with the corresponding portion of the opposite labium, and separated from the external surface by a free convex border. They are thicker in front, where they run into the mons veneris, and thinner behind, where they are united, in front of the perinæum, by a thin fold of integument called the fourchette, which is almost invariably ruptured in the first labor. In the virgin the labia are closely in apposition, and conceal the rest of the generative organs. After childbearing they become more or less separated from each other, and in the aged they waste, and the internal nymphæ protrude through them. Both the cutaneous and mucous surfaces of the labia contain a large number of sebaceous glands, opening either directly on the surface or into the hair follicles. In structure they are composed of connective tissue, containing a varying amount of fat, and parallel with their external surface are placed tolerably close plexuses of elastic tissue, interspersed with regularly arranged smooth muscular fibres. These are described by Broca as forming a membranous sac, analogous to the dartos of the scrotum, to which the labia majora are analogous. Towards its upper and narrower end this is continuous with the external inguinal ring, and in it terminate some of the fibres of the round ligament. The analogy with the scrotum is farther borne out by the occasional hernial protrusion of the ovary into the labium, corresponding to the normal descent of the testis in the male.

The *labia minora*, or *nymphæ*, are two folds of mucous membrane, commencing below, on either side, about the centre of the internal surface of the labium externum, and converging as they proceed upwards, where they bifurcate as they approach each other. The lower branch of this bifurcation is attached to the clitoris, while the upper and larger unites with its fellow of the opposite side, and forms a fold round the clitoris, known as its prepuce. The nymphæ are usually entirely concealed by the labia majora, but after childbearing and in old age they project somewhat beyond them, when they lose their delicate pink color and soft texture, and become brown, dry, and like skin in appearance. This is especially the case in some of the negro races, in whom they form long projecting folds called the apron.

The surfaces of the nymphæ are covered with a tessellated epithelium, and over them are distributed a large number of vascular papillæ, somewhat enlarged at their extremities, and also numerous sebaceous glands, which are more developed on their internal surfaces. The latter secrete an odorous, cheesy matter, which lubricates the surface of the vulva and prevents its folds adhering to each other. Structurally the nymphæ are composed of trabeculæ of connective tissue, containing muscular fibres.

The *clitoris* is a small erectile tubercle situated about half an inch below the anterior commissure of the labia majora. It is the analogue of the penis in the male, and is similar to it in structure, consisting of a corpus cavernosum, the two halves of which are separated by a fibrous septum. The crura are covered by the ischio-cavernous muscles, which serve the same purpose as in the male. It has also a suspensory ligament. The corpora cavernosa are composed of a vascular plexus with numerous traversing muscular fibres. The arteries are derived from the perinæal artery, and give a branch, the cavernous, to each half of the organ, and there is also a dorsal artery distributed to the prepuce. According to Gussenbauer, these cavernous arteries pour their blood directly into large veins, and a finer venous plexus near the surface receives arterial blood through small arterial branches. By these arrangements the erection of the organ which takes place during sexual excitement is favored. The nervous supply of the clitoris is large, being derived from the internal pudic nerve, which supplies branches to the corpora cavernosa, and terminates in the glands and prepuce, where Pacinian corpuscles and terminal bulbs are to be found. On this account the clitoris has been supposed by some to be the chief seat of voluptuous sensation in the female.

The *vestibule* is a triangular space, bounded at its apex by the clitoris, and on either side by the folds of the nymphæ. It is smooth, and, unlike the rest of the vulva, is destitute of sebaceous glands, although there are several groups of muciparous glands opening on its surface. At the centre of the base of the triangle which is formed by the upper edge of the opening of the vagina, is a prominence, distant about an inch from the clitoris, on which is the orifice of the urethra. This prominence can be readily made out by the finger, and the depression leading to the urethra can be felt upon it, and it is of importance as our guide in passing the female catheter. This little operation ought to be performed without exposing the patient, and it is done in several ways. The easiest is to place the top of the index finger of the left hand (the patient lying on her back) on the apex of the vestibule, and slip it gently down until we feel the bulb of the urethra, and the dimple of its orifice, which is generally readily found. If there is any difficulty in finding the orifice, it is well to remember that it is placed immediately below the sharp edge of the lower border of the symphysis pubis, which will guide us to it. The catheter (and a male elastic catheter is always the best, especially during labor, when the urethra is apt to be stretched) is then passed under the thigh of the patient, and directed to the orifice of the urethra by the finger of the left hand, which is placed upon it. We must be careful that the instrument is really passed into the urethra itself, and not into the vagina. It is advisable to have a few feet of elastic tubing attached to the end of the catheter, so that the urine can be passed into a vessel under the bed without uncovering the patient. If the patient be on her side, in the usual obstetric position, the operation can be more readily performed by placing the tip of the finger in the vagina and feeling its upper edge. The orifice of the urethra lies immediately over this, and if the catheter be slipped along the palmar surface of the finger it can generally be inserted into the urethra without much trouble. If, however, as is often the case during labor, the parts are much swollen, it may be difficult to find the aperture, and it is then always better to look for the opening than to hurt the patient by long-continued efforts to feel it.

The *urethra* itself is a canal 1½ inches in length, and it is intimately connected with the anterior wall of the vagina, through which it may be felt. It is composed of muscular and erectile tissue, and is remarkable for its extreme dilatability, a property which is turned to practical account in some of the operations for stone in the female bladder.

The *orifice of the vagina* is situated immediately below the bulb of the urethra. In virgins it is a circular opening, while in women who have borne children or practised sexual intercourse it is, in the undistended state, a vertical fissure. In virgins it is generally more or less blocked up by a fold of mucous membrane, containing some cellular tissue and muscular fibres, with vessels and nerve fibres, which is known as the *hymen.* This is most often crescentic in shape, with the concavity of the crescent looking upwards; sometimes, however, it is circular with a central opening, or cribriform, or it may even be entirely imperforate, and this gives rise to the retention of the menstrual secretion. These varieties of form depend on the peculiar mode of development of the fold of vaginal mucous membrane which blocks up the orifice of the vagina in the fœtus, and from which the hymen is formed. The density of the membrane also varies in different individuals. Most usually it is very slight, so as to be ruptured in the first sexual approaches, or even by some accidental circumstance, such as stretching the limbs, so that its absence cannot be taken as evidence of want of chastity. A knowledge of this fact is of considerable importance from a medico-legal point of view. Sometimes it is very tough, so as to prevent intercourse altogether, and to require division by the knife or scissors before this can be effected, and at others it rather unfolds than ruptures, so that it may exist even after impregnation has been effected, and it has been met with intact in women who have habitually led unchaste lives.

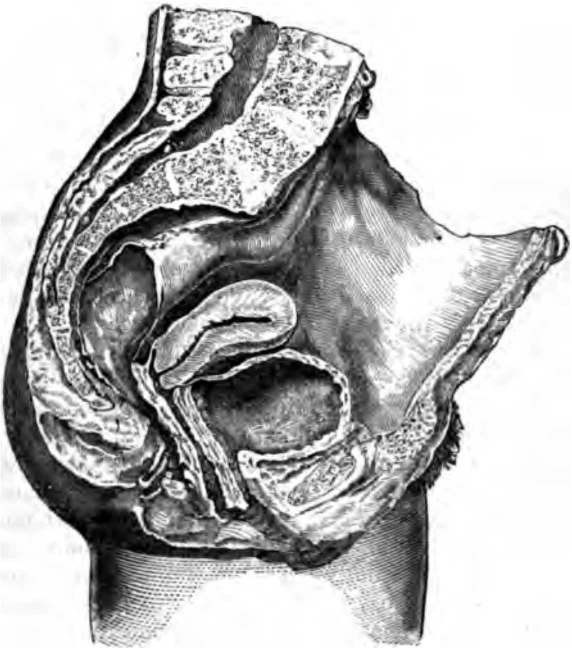
The *carunculæ myrtiformes* are small fleshy tubercles, varying from two to five in number, situated round the orifice of the vagina, and which are supposed to be formed by the remains of the ruptured hymen.

Vulvo-vaginal Glands.—Near the posterior part of the vaginal orifice, and below the superficial perinæal fascia, are situated two conglomerate glands which are the analogues of Cowper's glands in the male. Each of these is about the size and shape of an almond, and is contained in a cellular fibrous envelope. Internally they are of a yellowish-white color, and are composed of a number of lobules separated from each other by prolongations of the external envelope. These give origin to separate ducts which unite into a common canal, about half an inch in length, which opens in front of the attached edge of the hymen in virgins, and in married women at the base of one of the carunculæ myrtiformes. According to Huguier, the size of the glands varies much in different women, and they appear to have some connection with the ovary, as he has always found the largest gland to be on the same side as the largest ovary. They secrete a glairy, tenacious fluid, which is ejected in jets during the sexual orgasm, probably [illegible] spasmodic action of the perinæal muscles. At other [illegible] of the penis in the male, and is similar to it in structure, consisting of a corpus cavernosum, the two halves of which are separated by a fibrous septum. The crura are covered by the ischio-cavernous muscles, which serve the same purpose as in the male. It has also a suspensory ligament. The corpora cavernosa are composed of a vascular plexus with numerous traversing muscular fibres. The arteries are derived from the perinæal artery, and give a branch, the cavernous, to each half of the organ, and there is also a dorsal artery distributed to the prepuce. According to Gussenbauer, these cavernous arteries pour their blood directly into large veins, and a finer venous plexus near the surface receives arterial blood through small arterial branches. By these arrangements the erection of the organ which takes place during sexual excitement is favored. The nervous supply of the clitoris is large, being derived from the internal pudic nerve, which supplies branches to the corpora cavernosa, and terminates in the glands and prepuce, where Pacinian corpuscles and terminal bulbs are to be found. On this account the clitoris has been supposed by some to be the chief seat of voluptuous sensation in the female.

The *vestibule* is a triangular space, bounded at its apex by the clitoris, and on either side by the folds of the nymphæ. It is smooth, and, unlike the rest of the vulva, is destitute of sebaceous glands, although there are several groups of muciparous glands opening on its surface. At the centre of the base of the triangle which is formed by the upper edge of the opening of the vagina, is a prominence, distant about an inch from the clitoris, on which is the orifice of the urethra. This prominence can be readily made out by the finger, and the depression leading to the urethra can be felt upon it, and it is of importance as our guide in passing the female catheter. This little operation ought to be performed without exposing the patient, and it is done in several ways. The easiest is to place the top of the index finger of the left hand (the patient lying on her back) on the apex of the vestibule, and slip it gently down until we feel the bulb of the urethra, and the dimple of its orifice, which is generally readily found. If there is any difficulty in finding the orifice, it is well to remember that it is placed immediately below the sharp edge of the lower border of the symphysis pubis, which will guide us to it. The catheter (and a male elastic catheter is always the best, especially during labor, when the urethra is apt to be stretched) is then passed under the thigh of the patient, and directed to the orifice of the urethra by the finger of the left hand, which is placed upon it. We must be careful that the instrument is really passed into the urethra itself, and not into the vagina. It is advisable to have a few feet of elastic tubing attached to the end of the catheter, so that the urine can be passed into a vessel under the bed without uncovering the patient. If the patient be on her side, in the usual obstetric position, the operation can be more readily performed by placing the tip of the finger in the vagina and feeling its upper edge. The orifice of the urethra lies immediately over this, and if the catheter be slipped along the palmar surface of the finger it can generally be inserted into the urethra without much trouble. If, however, as is often the case during labor, the parts are much swollen, it may be thin layer of muscular tissue surrounding the orifice of the vagina, and described as the constrictor vaginæ.

The *vagina* is the canal which forms the communication between the external and internal generative organs, through which the semen passes to reach the uterus, the menses flow, and the fœtus is expelled. Roughly speaking, it lies in the axis of the pelvis, but its opening is placed anterior to the axis of the pelvic outlet, so that its lower portion is curved forwards. It is narrow below, but dilated above, where the cervix uteri is inserted into it, so that it is more or less conoidal in shape. Generally speaking, however, its anterior and posterior walls lie closely in contact with each other, but they are capable of very wide distension, as during the passage of the fœtus. The anterior wall of the vagina is shorter than the posterior, the former measuring on an average 2½ inches, the latter 3 inches; but the length of the canal varies greatly in different subjects and under certain circumstances. In front the vagina is closely connected with the posterior surface of the bladder, so much so that when the vagina is prolapsed, as often occurs, it drags the bladder with it (Fig. 15); behind, it is in relation with the rectum, but less intimately; laterally, with the broad ligaments and pelvic fascia; and superiorly, with the lower portion of the uterus and folds of peritoneum both before and behind. The vagina is composed of mucous, muscular, and cellular coats. The mucous lining is thrown into numerous folds. These start from longitudinal ridges which exist

FIG. 15.



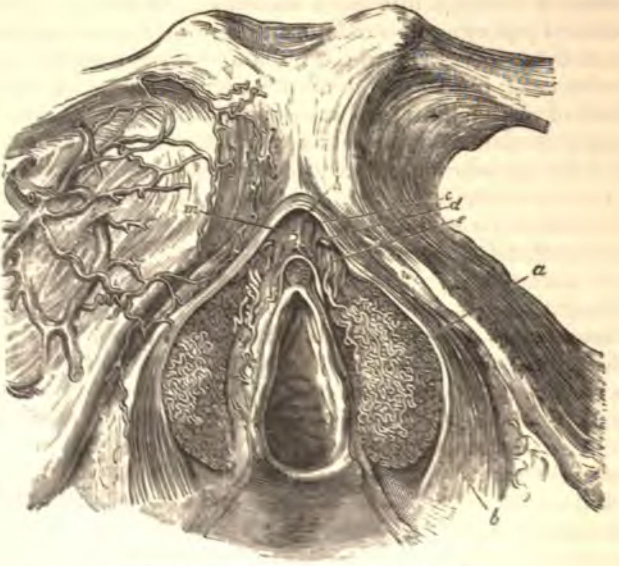
LONGITUDINAL SECTION OF BODY, SHOWING RELATIONS OF GENERATIVE ORGANS.

purpose of lubricating the vulva, and thus preserving the sensibility of its mucous membrane.

Immediately behind the hymen in the unmarried, and between it and the perinæum, is a small depression called the *fossa navicularis*, which disappears after childbearing.

The *perinæum* separates the orifice of the vagina from that of the rectum. It is about 1½ inches in breadth, and is of great obstetric interest, not only as supporting the internal organs from below, but because of its action in labor. It is largely stretched and distended by the presenting part of the child, and if unusually tough and unyielding may retard delivery, or it may be torn to a greater or less extent, thus giving rise to various subsequent troubles.

FIG. 14.

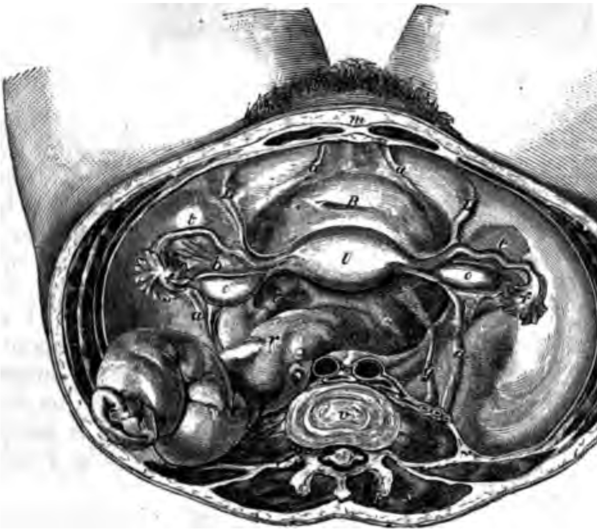


VASCULAR SUPPLY OF VULVA. [After Kobelt.]

a. Bulb of vestibule. *b*. Muscular tissue of vagina. *c*, *d*, *e*, *f*. The clitoris and its muscles. *g*, *h*, *i*, *k*, *l*, *m*, *n*. Veins of the nymphæ and clitoris communicating with the epigastric and obturator veins.

The structures described above, together constitute the *vulva*, and the whole of them are remarkable for their abundant vascular and nervous supply. The former constitutes an erectile tissue similar to that which has already been described in the clitoris, and which is especially marked about the bulb of the vestibule (Fig. 14). From this point, and extending on either side of the vagina, there is a well-marked plexus of convoluted veins, which, in their distended state, are likened by Dr. Arthur Farre to a filled leech. The erection of the erectile tissue so formed, as well as that of the clitoris, is brought about under excitement, as in the male, by the compression of the efferent veins by the contraction of the ischio-cavernous muscles, and by that of a viscera, especially the bladder and rectum, which are subjected to variations of size according to their fulness or emptiness. When from any cause—as, for example, some peri-uterine inflammation producing adhesions to the surrounding textures—the mobility of the organ is interfered with, much distress ensues, and if pregnancy supervenes more or less serious consequences may result. Generally speaking, the uterus may be said to lie in a line roughly corresponding with the axis of the pelvic brim, its fundus being pointed forwards and its cervix lying in such a direction that a line drawn from it would impinge on the junction between the sacrum and coccyx. According to some authorities, the uterus in early life is more curved in the anterior direction, and is, in fact, normally in a state of anteflexion. Sappey holds that this is not necessarily the case, but that the amount of anterior curvature depends on the vacuity or fulness of the bladder, on which the uterus, as it were, moulds itself in the unimpregnated state. It is believed also that the body of the uterus is very generally twisted somewhat obliquely, so that its anterior surface looks a little towards the right side, this probably depending on the presence and frequent distension of the rectum in the left side of the pelvis. The anterior surface of the uterus is convex, and is covered in three-fourths of its extent by the peritoneum, which is intimately adherent to it. Below the reflection of that membrane it is loosely connected by cellular tissue to the bladder, so that any downward displacement of the uterus drags the bladder along with it. The posterior surface is also convex, but more distinctly so than

FIG. 16.



TRANSVERSE SECTION OF BODY, SHOWING RELATIONS OF THE FUNDUS UTERI.

m. Pubes. *a*, *a* (in front). Remainder of hypogastric arteries. *a*, *a* (behind). Spermatic vessels and nerves. *B*. Bladder. *L*, *L*. Round ligaments. *v*. Fundus uteri. *t*, *t*. Fallopian tubes. *o*, *o*. Ovaries. *r*. Rectum. *g*. Right ureter, resting on the psoas muscle. *c*. Utero-sacral ligaments. *v*. Last lumbar vertebra.

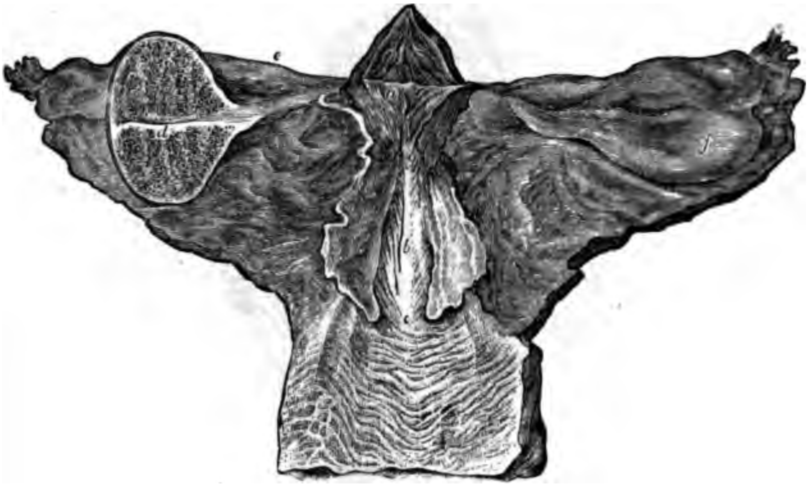
on both the anterior and posterior walls, but most distinctly on the anterior. They are very numerous in the young and unmarried, and greatly increase the sensitive surface of the vagina. After childbearing, and in the aged, they become atrophied, but they never completely disappear, and towards the orifice of the vagina, where they exist in greatest abundance, they are always to be met with. The whole of the mucous membrane is lined with tessellated epithelium, and it is covered with a large number of papillæ, either conical or divided, which are highly vascular and project into the epithelial layer. Unlike the vulvar mucous membrane, that of the vagina seems to be destitute of glands. Beneath the epithelial layer is a submucous tissue containing a large number of elastic and some muscular fibres, derived from the muscular walls of the vagina. These are strong and well developed, especially towards the ostium vaginæ. They consist of two layers, an internal longitudinal, and an external circular, with oblique decussating fibres connecting the two. Below they are attached to the ischio-pubic rami, and above they are continuous with the muscular coat of the uterus. The muscular tissue of the vagina increases in thickness during pregnancy, but to a much less degree than that of the uterus. Its vascular arrangements, like those of the vulva, are such as to constitute an erectile tissue. The arteries form an intricate network around the tube, and eventually end in a submucous capillary plexus, from which twigs pass to supply the papillæ; these again give origin to venous radicles which unite into meshes freely interlacing with each other, and forming a well-marked venous plexus.

2. The *internal organs of generation* consist of the uterus, the Fallopian tubes, and the ovaries; and in connection with them we have to study the various ligaments and folds of peritoneum which serve to maintain the organs in position, along with certain accessory structures. Physiologically, the most important of all the generative organs are the ovaries, in which the ova are formed, and which dominate the entire reproductive life of the female. The Fallopian tubes which convey the ovum to the uterus, and the uterus itself—whose main function is to receive, nourish, and eventually expel the impregnated product of the ovary—may be said to be, in fact, accessory to these viscera. Practically, however, as obstetricians, we are chiefly concerned with the uterus, and may conveniently commence with its description.

The *uterus* is correctly described as a pyriform organ, flattened from before backwards, consisting of the body, with its rounded fundus, and the cervix which projects into the upper part of the vaginal canal. In the adult female it is deeply situated in the pelvis, being placed between the bladder in front and the rectum behind, its fundus being below the plane of the pelvic brim (Fig. 16). It only assumes this position, however, towards the period of puberty; and in the fœtus it is placed much higher, and lies, indeed, entirely within the cavity of the abdomen. It is maintained in this position partly by being slung by its ligaments, which we shall subsequently study, and partly by being supported from below by the pelvic cellular tissue and the fleshy column of the vagina. The result is that the uterus, in the healthy female, is a perfectly movable body, altering its position to suit the condition of the surrounding scribed as giving a sensation to the examining finger like the extremity of the cartilage at the tip of the nose. It is bounded by two lips, the anterior of which is apparently larger on account of the position of the uterus. The surface of the cervix and the borders of the os are very smooth and regular.

Changes after Childbirth.—In women who have borne children these parts become considerably altered. The cervix is no longer conical in shape, but becomes shorter and irregular in form. The lips of the os uteri become fissured and lobulated, on account of partial lacerations which have occurred during labor. The os itself is larger and more irregular in outline, and is sometimes sufficiently patulous to admit the tip of the finger. In old age the cervix atrophies, and after the change of life it not uncommonly entirely disappears, so that the orifice of the os uteri is on a level with the roof of the vagina.

FIG. 18.



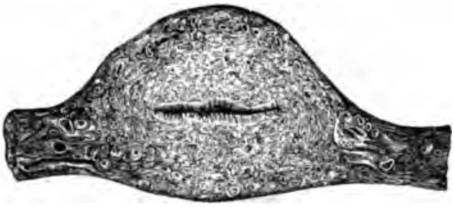
UTERUS AND APPENDAGES IN AN INFANT.

The *internal surface of the uterus* comprises the cavities of the body of the uterus and of the cervix, the former being rather less than the latter in length in virgins, but about equal in women who have borne children, and which are separated from each other by a constriction forming the upper boundary of the cervical canal. The cavity of the body of the womb is triangular in shape, the base of the triangle being formed by a line joining the openings of the Fallopian tubes, its apex by the upper orifice of the cervix, or internal os, as it is sometimes called. In the virgin its boundaries are somewhat convex, projecting inwards. After childbearing they become straight or slightly concave. The opposing surfaces of the cavity are always in contact in the healthy state, or, at least, are only separated from each other by a small quantity of mucus.

The *cavity of the cervix* is spindle-shaped or fusiform,
above and below, at the internal and external os uteri, and

the anterior, as may be observed in looking at a transverse section of the organ (Fig. 17). It is also covered by peritoneum, the reflection of which on the rectum forms the cavity known as Douglas's pouch. The fundus is the upper extremity of the uterus, lying above the point of entry of the Fallopian tube. It is only slightly rounded in the virgin, but becomes more decidedly and permanently rounded in the woman who has borne children.

FIG. 17.



TRANSVERSE SECTION OF UTERUS.

Dimensions.—Until the period of puberty the uterus remains small and undeveloped (Fig. 18); after that time it reaches the adult size, at which it remains until menstruation ceases, when it again atrophies. If, however, the woman has borne children, it always remains larger than in the nullipara. In the virgin adult it measures 2½ inches from the orifice of the uterus to the fundus, rather more than half of this being taken up by the cervix. Its greatest breadth is opposite the insertion of the Fallopian tubes, its greatest thickness, about 11 or 12 lines, opposite the centre of its body. Its average weight is about 9 or 10 drachms. Independently of pregnancy, the uterus is subject to great alterations of size towards the menstrual period, when, on account of the congestion then present, it increases, sometimes, it is said, considerably. This fact should be borne in mind, as this periodical swelling might be taken for an early pregnancy.

Regional Divisions.—For the purpose of description the uterus is conveniently divided into the *fundus*, with its rounded upper extremity, situated between the insertion of the Fallopian tubes; the *body*, which is bounded by the insertion of the Fallopian tubes above and by the upper extremity of the cervix below, and which is the part chiefly concerned in the reception and growth of the ovum; and the *cervix*, which projects into the vagina, and dilates during labor to give passage to the child. The latter is conical in shape, measuring 11 to 12 lines in thickness transversely at the base, and 6 or 7 in the antero-posterior direction; while at the apex it measures 7 to 8 transversely, and 5 antero-posteriorly. It projects about 4 lines into the canal of the vagina, the remainder of the cervix being placed above the reflection of the vaginal mucous membrane. It varies much in form in the virgin and nulliparous married woman, and in the woman who has borne children, and the differences are of importance in the diagnosis of pregnancy and uterine disease. In the virgin it is regularly pyramidal in shape. At its extremity is the opening of the os uteri, forming a small transverse fissure, sometimes difficult to feel, and generally described as giving a sensation to the examining finger like the extremity of the cartilage at the tip of the nose. It is bounded by two lips, the anterior of which is apparently larger on account of the position of the uterus. The surface of the cervix and the borders of the os are very smooth and regular.

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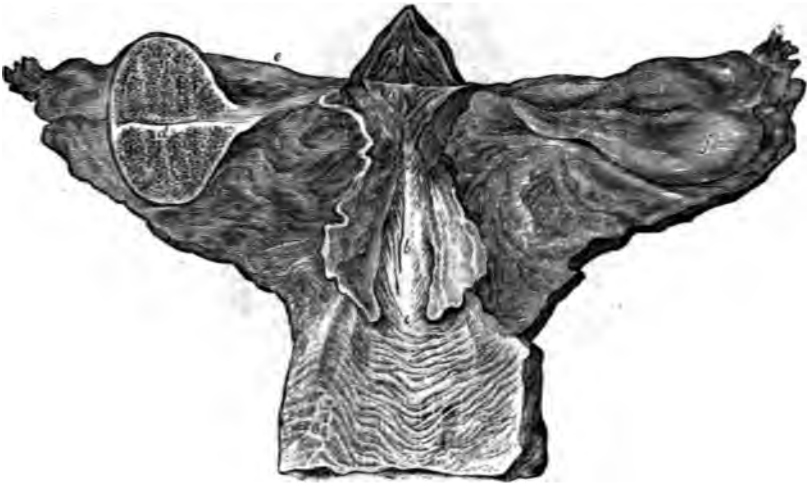

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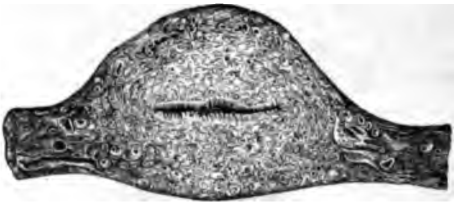

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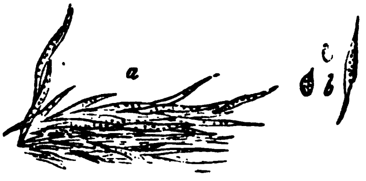
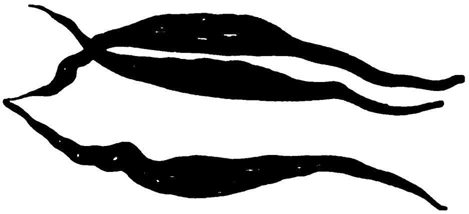
Its Peritoneal Investment.—At the upper part of the organ the peritoneum is so closely adherent to the proper uterine tissue that it cannot be separated from it; below the junction is more loose. The mass of the uterine tissue, both in the body and cervix, consists of unstriped muscular fibres, firmly united together by nucleated connective tissue and elastic fibres. The muscular fibre cells are large and fusiform, with very attenuated extremities, containing generally in their centre a distinct nucleus. These cells, as well as their nuclei, become greatly enlarged during pregnancy (Fig. 21), but, according to Stricker, this is only the case with the muscular fibres which play an important part in the expulsion of the fœtus, those of the outermost and innermost layers not sharing in the increase of size.[1] In addition to these developed fibres there are present, especially near the mucous coat, a number of round elementary corpuscles which are believed by Dr. Farre[2] to be the elementary form of the muscular fibres, and which he has traced in various intermediate states of development.

FIG. 20.



MUSCULAR FIBRES OF UNIMPREGNATED UTERUS.
a. Fibres united by connective tissue.
b. Separate fibres and elementary corpuscles.

FIG. 21.



DEVELOPED MUSCULAR FIBRES FROM THE GRAVID UTERUS.

On examining the uterine tissue in an unimpregnated condition, no definite arrangement of its muscular fibres can be made out, and the whole seem blended in inextricable confusion. By observation of their relations when hypertrophied during pregnancy, Helié[3] has shown that they may, speaking roughly, be divided into three layers: an external, a middle, chiefly longitudinal, and an internal, chiefly circular. Into the details of their distribution, as described by him, it is needless to enter at length. Briefly, however, he describes the external layer as arising posteriorly at the junction of the body and cervix, and spreading upwards and over the fundus. From this are derived the muscular fibres found in the broad and round ligaments, and more particularly described by Rouget. The middle layer is made up of strong fasciculi, which run upwards, but decussate and unite with each other in a remarkable manner, so that those which are at first superficial become most deeply seated, and vice versâ. The muscular fasciculi which form this coat curve in a circular manner around the large veins which penetrate it, so as to form a species of muscular canal through which they run. This arrangement is of peculiar importance, as it affords a satisfactory explanation of the mechanism by which hemorrhage after delivery is prevented. The internal layer is mainly composed of circular rings of muscular fibres, beginning round the openings of the Fallopian tubes, and forming wider and wider circles which eventually touch and interlace with each other. Part of these circular fibres surround the internal os, to which they form a kind of sphincter. In addition to these on the internal uterine surface, both anteriorly and posteriorly, there is a well-marked triangular layer of longitudinal fibres, the base being above and the apex below, which sends muscular fasciculi into the mucous membrane.

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[1] Comparative Histology, vol. iii., Syd. Soc. Trans., p. 477.
[2] The Uterus and its Appendages, p. 632.
[3] Recherches sur la Disposition des Fibres musculaires de l'Utérus. Paris, 1869.

Its Mucous Membrane.—The anatomy of the lining membrane of the uterus has been the subject of considerable discussion. Its existence has been denied by many authorities, most recently by Snow Beck,[1] who maintains that it is in no sense a mucous membrane, but only a softened portion of true uterine tissue. It is, however, pretty generally admitted by the best authorities that it is essentially a mucous membrane, differing from others only in being more closely adherent to the subjacent structures, in consequence of not possessing any definite connective-tissue framework.

It is a pale pink membrane of considerable thickness, most marked at the centre of the body, where it forms from $\frac{1}{8}$th to $\frac{1}{4}$th of the thickness of the whole uterine walls. At the internal os uteri it terminates by a distinct border, which separates it from the mucous membrane lining the cervical cavity.

The Utricular Glands.—On the surface of the mucous membrane may be observed a multitude of little openings, about $\frac{1}{30}$th of a line in width (Fig. 22). These are the orifices of the utricular glands, which are found in immense numbers all over the cavity of the uterus, and very closely agglomerated together. They are little cul-de-sacs, wider at their mouths than in their length, the blind extremities of which are found in the subjacent tissues. Dr. John Williams, in a recent excellent paper,[2] describes them as running obliquely towards the surface at the lower third of the cavity, perpendicularly at its middle, while towards the fundus they are at first perpendicular and then oblique in their course. By others they are described as being often twisted and corkscrew-like. One or more may unite to form a common orifice, several of which may open together in little pits or depressions on the surface of the mucous membrane. They are composed of structureless membrane lined with epithelium, the precise character of which is doubtful. By some it is described as columnar, by others tessellated, and by some again as ciliated. The most generally received opinion is that it is columnar, but not ciliated, therein differing from the epithelium covering the surface of the membrane, which is undoubtedly ciliated, the movements of the cilia being from within outwards. Williams, however, has observed cilia in active movement in the columnar epithelium lining the glands, and also states that when these are attached to the muscular walls at their deep-seated extremities, which penetrate between the muscular fibres for some distance, the columnar epithelium is replaced by rounded cells. The capillaries of the mucous membrane run down between the tubes, forming a lacework on their surface, and round their orifices. No true papillæ exist in the membrane lining the uterine cavity. The mucous membrane of the uterus is peculiar in being always in a state of change and alteration, being thrown off at each menstrual period in the form of débris, in consequence of fatty degeneration of its structures, and reformed afresh by proliferation of the cells forming the muscular and connective tissue, probably from below upwards, the new membrane commencing at the internal os. Hence its appearance and structure will vary considerably according to the time at which it is examined. This subject, however, must be more particularly studied in connection with menstruation.

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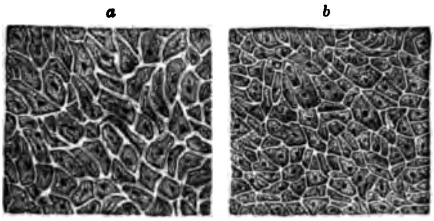
[1] Obst. Trans., vol. xiii. p. 294.

[2] "On the Structure of the Mucous Membrane of the Uterus." Obstet. Journ., 1875.

FIG. 22.



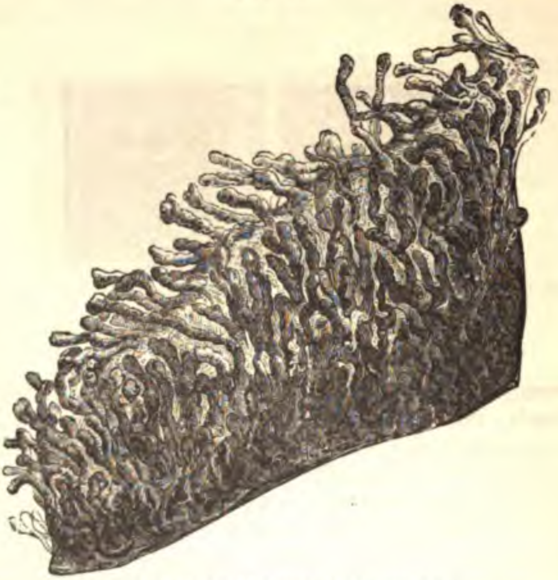
LINING MEMBRANE OF UTERUS, SHOWING NETWORK OF CAPILLARIES AND ORIFICES OF UTERINE GLANDS.

a. From the body. *b*. From orifice of Fallopian tube.

The *mucous membrane of the cervix* is much thicker and more transparent than that of the cavity of the uterus, from which it also differs in certain structural peculiarities. The general arrangements of its folds and surface have already been described. The lower half of the membrane lining the cavity of the cervix, and the whole of that covering its external or vaginal portion, is closely set with a large number of minute filiform or clavate papillæ (Fig. 23). Their structure is similar to that of the mucous membrane itself, of which they seem to be merely notches or indentations. They each contain a vascular loop (Fig. 24), and they are believed by Kilian and Farre to be mainly concerned in forming the sensory portion of this part of the generative tract. All over the interior of the cervix, both on the ridges of the mucous membrane and between their folds, are observed a very large number of mucous follicles, consisting of a structureless membrane lined with cylindrical epithelium and intimately united with the connective tissue. They cease at the external orifice of the cervix, and they secrete the thick, tenacious and alkaline mucus which is generally found filling the cervical cavity. The smaller transparent follicles, known as the "ovula Nabothii," which are sometimes found in considerable numbers in the cavity of the cervix, appear to consist of mucous follicles the mouths of which have become obstructed and their canals distended by mucous secretion. The lower third of the cervical canal, as well as the exterior of the cervix, is covered with a pavement epithelium, while in its upper portion is found a columnar and ciliated epithelium similar to that lining the uterine cavity.

Vessels of the Uterus.—The arteries of the uterus are derived from the uterine branches of the internal iliac, and from the ovarian. They enter the uterus between the folds of the broad ligaments, and, penetrating its muscular coat, anastomose freely with each other and with the corresponding vessels of the opposite side. Their walls are thick and well developed, and they are remarkable for their very tortuous course, forming spiral curves, especially in the upper part of the uterus. They end in minute capillaries forming the fine meshes surrounding the uterine glands, and, in the cervix, giving off the loops which enter the papillæ. Beneath the uterine mucous membrane these capillaries form a vascular plexus, terminating in veins without valves, which unite with each other to form the large veins traversing the substance of the uterus, known as the uterine sinuses, the walls of which are closely adherent to the uterine tissues. These sinuses, freely anastomosing with each other, pass outwards to the folds of the broad ligaments, where they unite to form, with the ovarian and vaginal veins, a large and well-developed venous network, known as the *pampiniform plexus*.

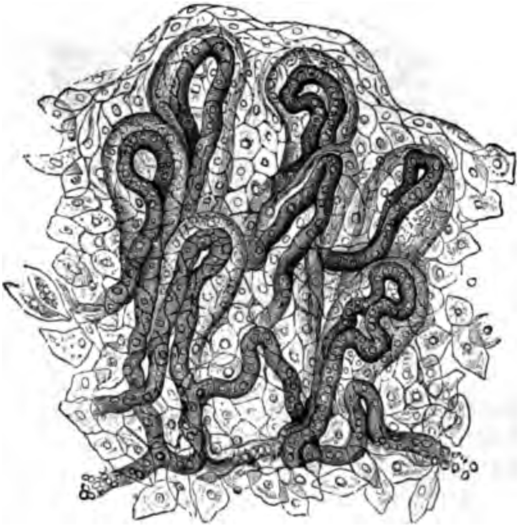
FIG. 23.



VILLI OF OS UTERI STRIPPED OF EPITHELIUM.

The *lymphatics of the uterus* are large and well developed, and they have recently, and with much probability, been supposed to play an important part in the production of certain puerperal diseases. A more minute knowledge of their course and distribution than we at present possess will probably throw much light on their influence in this respect. According to the recent researches of Leopold,[1] who has studied their minute anatomy carefully, they originate in lymph spaces between the fine bundles of connective tissue forming the basis of the mucous lining of the uterus. Here they are in intimate contact with the utricular glands and the ultimate ramifications of the uterine blood-vessels. As they pass into the muscular tissue they become gradually narrowed into lymph-vessels and spaces, which have a very complicated arrangement, and which eventually unite together in the external muscular layer, especially on the sides of the uterus, to form large canals which probably have valves. Immediately under the peritoneal covering these lymph-vessels form a large and characteristic network, covering the anterior and posterior surfaces of the uterus, and presenting, in various parts of their course, large ampullæ. They then spread over the Fallopian tubes. The lymphatics of the body of the uterus unite with the lumbar glands, those of the cervix with the pelvic glands.

FIG. 24



VILLI OF UTERUS, COVERED WITH PAVEMENT EPITHELIUM, AND CONTAINING LOOPED VESSELS.

The Nerves of the Uterus.—The distribution and arrangement of the nerves of the uterus have been the subject of much controversy. They are derived mainly from the ovarian and hypogastric plexuses, inosculating freely with each other between the folds of the broad ligament, from which they enter the muscular tissue of the uterus, generally, but not invariably, following the course of the arteries. They are chiefly derived from the sympathetic; but, as the hypogastric plexus is connected with the sacral nerves, it is probable that some tubules from the cerebro-spinal system are distributed to the cervix. It is now generally admitted that nervous filaments are distributed to the cervix, even as far as the external os, although their existence in this situation has been denied by Jobert and other writers. The ultimate distribution of the nerves is not yet made out. Polle[1] describes a nerve filament as entering the papillæ of the cervical mucous membrane along with the capillary loop, and Frankenhauser says[2] the nerve fibres surround the muscles of the uterus in the form of plexuses, and eventually terminate in the nuclei of the muscle cells.

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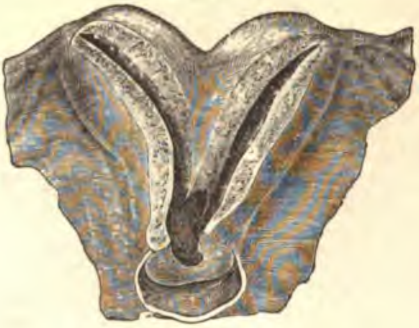
[1] Arch. f. Gynäk., Bd. vi. Heft i.

Anomalies of the Uterus.—Various abnormal conditions of the uterus and vagina are occasionally met with, which it is necessary to mention, as they may have an important practical bearing on parturition. The most frequent of these is the existence of a double, or partially double, uterus (Fig. 25), similar to that which exists normally in many of the lower animals. The existence of this abnormality is explained by the development of the organ during fœtal life. The uterus is formed out of structures existing only in early fœtal life, known as the Wolffian bodies. These consist of a number of tubes, situated on either side of the vertebral column, and opening internally into an excretory duct. Along their external border a hollow canal is formed, termed the canal of Müller, which, like the excretory ducts, proceeds to the common cloaca of the digestive and urinary organs which then exists. The canal of Müller unites with its fellow of the opposite side to form the uterus and Fallopian tubes in the female, and subsequently the central partition at their point of junction disappears. If, however, the progress of development is in any way checked, we may have the central partition remaining. Then we have produced either a complete double uterus, or the uterus bicornis, which is bifid at its upper extremity only, or a double vagina, each leading to a separate uterus. If pregnancy

FIG 25.



BIFID UTERUS.

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[1] Die Nerven-Verbreitung in den Weiblichen Genitalien, 1865.
[2] Nerven der Gebärmutter, 1867.

occurs in any of these anomalous uteri (and many such cases are recorded), serious troubles may follow.

Pregnancy of Bifid Uterus.—It may happen that the one horn of a double uterus is not sufficiently large to admit of pregnancy going on to term, and rupture may occur. It is supposed that some cases, presumed to be tubal gestation, were really explicable on this hypothesis. Impregnation may also occur in the two cornua at different times, leading to superfœtation. It is, however, quite possible that impregnation may occur in one or other horn of a bifid uterus, and labor be completed without anything unusual being observed. A remarkable case of this sort was recently recorded by Dr. Ross of Brighton,[1] in which a patient miscarried of twins on July 16, 1870, and subsequently, fifteen weeks later, on October 31, she was delivered of a healthy child. Careful subsequent examination showed the existence of a complete double uterus, each side of which had been impregnated. Curiously enough, this patient had formerly given birth to six living children at term, nothing remarkable having been observed in her labors. It can only rarely happen, however, that, under such circumstances, so favorable a result will follow, and more or less difficulty and danger may generally be expected. Occasionally the vagina only is double, the uterus being single. Dr. Matthews Duncan has recorded some cases of this kind,[2] in which the vaginal septum formed an obstacle to the birth of the child, and required division.

Ligaments of the Uterus.—The various folds of peritoneum which invest the uterus serve to maintain it in position, and they are described as its ligaments. They are the broad ligaments at either side, the vesico-uterine and sacro-uterine ligaments, and the round ligaments, which are not peritoneal folds like the others. The *broad ligaments* extend from either side of the uterus, where their laminæ are separated from each other, transversely across to the pelvic wall, and thus divide the cavity of the pelvis into two parts; the anterior containing the bladder, the posterior the rectum. Their upper borders are divided into three subsidiary folds, the anterior of which contain the round ligament, the middle the Fallopian tube, and the posterior the ovary. This arrangement has received the name of the ala vespertilionis, from its fancied resemblance to a bat's wing. Between the folds of the broad ligaments are found the uterine vessels and nerves, and a certain amount of loose cellular tissue continuous with the pelvic fasciæ. Here also is situated that peculiar structure called the organ of Rosenmüller, or the parovarium (Fig. 26), which is the remains of the Wolffian body. This may best be seen in young subjects, by holding up the broad ligaments and looking through them by transmitted light, although it exists at all ages. It consists of several tubes (eight or ten according to Farre, eighteen or twenty according to Bankes),[3] which are tortuous in their course. They are arranged in a pyramidal form, the base of the pyramid being towards the Fallopian tube, its apex being lost on the surface of the ovary. They are formed of fibrous tissue, and lined with pavement epithelium. They have no excretory duct, or communication with either the uterus or ovary, and their function, if they have any, is unknown.

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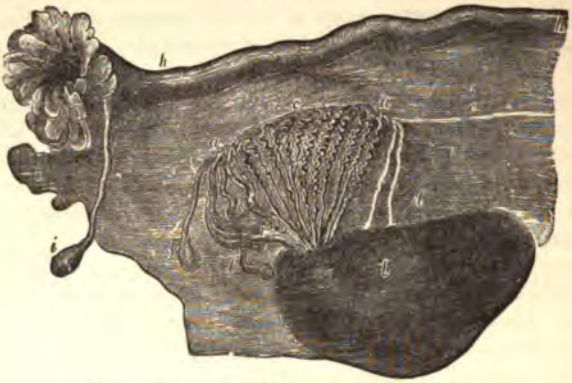
[1] Lancet, August, 1871.

[2] Researches in Obstetrics, p. 443.

[3] Bankes, On the Wolffian Bodies.

A number of muscular fibres are also found in this situation, lying between the meshes of the connective tissue. They have been particularly studied by Rouget, who describes them as interlacing with each other, and forming an open network, continuous with the muscular tissue of the uterus (Fig. 27). They are divisible into two layers, the anterior of which is continuous with the muscular fibres of the anterior surface of the uterus, and goes to form part of the round ligament; the posterior arises from the posterior wall of the uterus, and proceeds transversely outwards, to become attached to the sacro-iliac synchondrosis. A continuous muscular envelope is thus formed, which surrounds the whole of the uterus, Fallopian tubes, and ovaries. Its function is not yet thoroughly established. It is supposed to have the effect of retracting the stretched folds of peritoneum after delivery, and more especially of bringing the entire generative organs into harmonious action during menstruation and the sexual orgasm; and in this way explaining, as we shall subsequently see, the mechanism by which the fimbriated extremity of the Fallopian tube grasps the ovary prior to the rupture of a Graafian follicle.

FIG. 26.

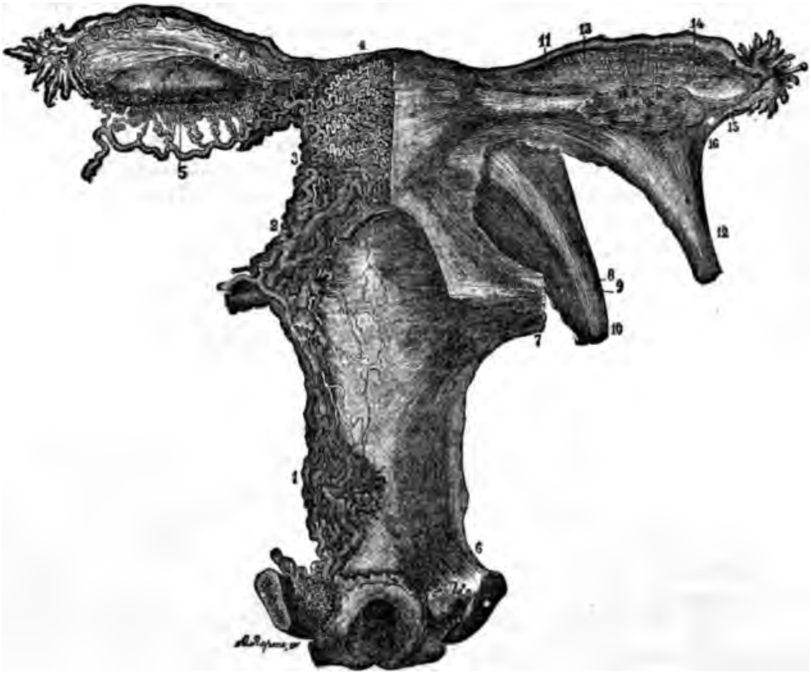


ADULT PAROVARIUM, OVARY, AND FALLOPIAN TUBE.

The *round ligaments* are essentially muscular in structure. They extend from the upper edge of the uterus, with the fibres of which its muscular fibres are continuous, transversely and then obliquely downwards, until they reach the inguinal rings, where they blend with the cellular tissue. In the first part of their course the muscular fibres are solely of the unstriped variety, but soon they receive striped fibres from the transversalis muscles, and the columns of the inguinal ring, which surround and cover the unstriped muscular tissue. In addition to these structures they contain elastic and connective tissue, and arterial, venous, and nervous branches; the former form the iliac or cremasteric arteries, the latter form the genito-crural nerve. According to Mr.

Rainey, the principal function of these ligaments is to draw the uterus towards the symphysis pubis during sexual intercourse, and thus to favor the ascent of the semen.

FIG. 27.



POSTERIOR VIEW OF MUSCULAR AND VASCULAR ARRANGEMENTS. (After Rouget.)
Vessels.—1, 2, 3. Vaginal, cervical, and uterine plexuses. 4. Arteries of body of uterus. 5. Arteries supplying ovary. *Muscular fasciculi.*—6, 7. Fibres attached to vagina, symphysis pubis, and sacro-iliac joint. 8. Muscular fasciculi from uterus and broad ligaments. 9, 10, 11, 12. Fasciculi attached to ovary and Fallopian tubes.

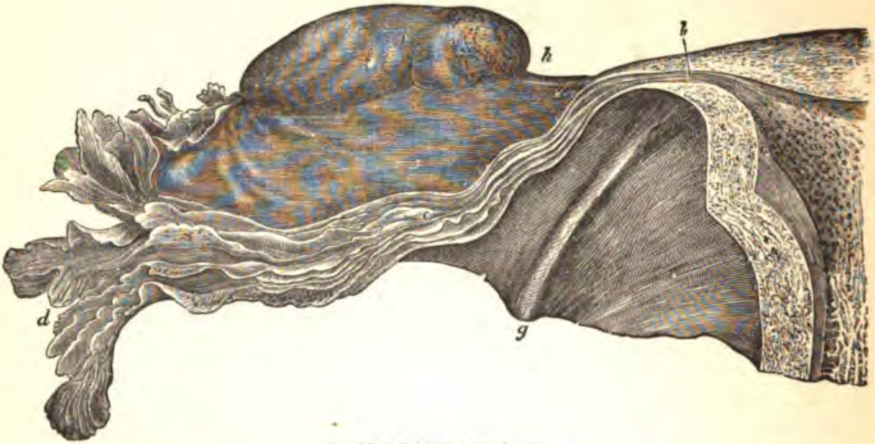
The *vesico-uterine ligaments* are two folds of peritoneum passing from the lower part of the body of the uterus in front to the fundus of the bladder.

The *utero-sacral ligaments* also consist of folds of peritoneum of a crescentic form, with their concavities looking inwards, which start from the lower part of the posterior surface of the uterus, and curve backwards to be attached to the third and fourth sacral vertebræ. Within their folds there exist bundles of muscular fibres, continuous with those of the uterus, as well as connective tissue, vessels, and nerves. The experiments of Savage, as well as of other anatomists, show that these ligaments have an important influence in preventing downward displacement of the womb.

During pregnancy all these structures become greatly stretched and unfolded, rising out of the pelvic cavity and accommodating themselves to the increased size of the gravid uterus, and again contracting to their former size, possibly through the agency of the muscular fibres contained within them, after delivery has taken place.

The *Fallopian tubes*, the analogues of the vasa deferentia in the male, are structures of great physiological interest. They serve the double purpose of conveying the semen to the ovary, and of carrying the ovum to the uterus. For the latter function they may be looked on as the excretory ducts of the ovaries, which, unlike other excretory ducts, are movable, so that they may apply themselves to the part of the ovaries from which the ovum is to come; and to so great an extent is their mobility developed, that there is reason to believe that the Fallopian tube may even grasp the ovary of the opposite side. They proceed from the upper angle of the uterus, at first transversely outwards, and then downwards, backwards, and inwards, so as to reach the neighborhood of the ovaries. In the first part of its course the tube is straight, afterwards it becomes flexuous and twisted on itself. It is contained in the upper part of the broad ligament, where it may be felt as a hard cord. It commences at the uterus by a narrow opening, admitting only the passage of a bristle, known as the *ostium uterinum*. As it passes through the muscular walls of the uterus the tube takes a somewhat curved course, and it opens in its cavity by a dilated aperture. From its uterine attachment the tube expands gradually until it terminates in its trumpet-shaped extremity; just before its distal end, however, it again contracts slightly. The ovarian end of the tube is surrounded by a number of remarkable fringe-like processes. These consist of longitudinal membranous fimbriæ, surrounding the aperture of the tube, like the tentacles of a polyp, varying considerably in number and size, and having their edges also cut and subdivided. On their inner surface are found both transverse and longitudinal folds of mucous membrane, continuous with those lining the tube itself (Fig. 28). One of these fimbriæ is always larger and more developed than the rest, and it is indirectly united to the surface of the ovary by a fold of peritoneum proceeding from its external surface. Its under surface is grooved so as to form a channel,

FIG. 28.



FALLOPIAN TUBE LAID OPEN.

a, b. Uterine portion of tube. *c, d.* Plicæ of mucous membrane. *e.* Tubo-ovarian ligaments and fringes. *f.* Ovary. *g.* Round ligament.

open below. The function of this fringe-like structure is obviously to grasp the ovary during the menstrual nisus, and the fimbria which is attached to the ovary would seem to guide the tentacles to the ovary which they are intended to seize. One or more supplementary series of fimbriæ sometimes exist, which have an aperture of communication with the canal of the Fallopian tube, beyond its ovarian extremity.

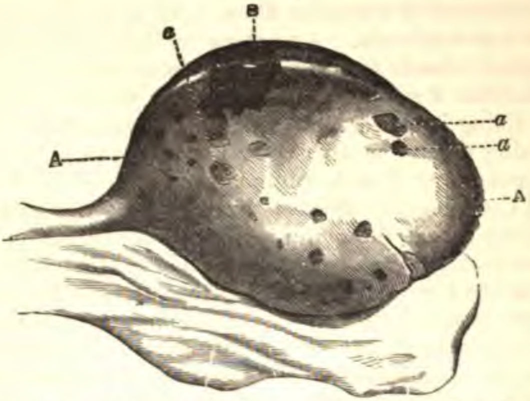
The tubes themselves consist of peritoneal, muscular, and mucous coats. The peritoneal surrounds the tube for three-fourths of its calibre, and comes into contact with the mucous lining at its fimbriated extremity, the only instance in the body where such a junction occurs. The muscular coat is principally composed of circular fibres, with a few longitudinal fibres interspersed. Its muscular character has been doubted by Robin and Richard, but Farre had no difficulty in demonstrating the existence of muscular fibres, both in the human female and many of the lower animals. According to Robin, the muscular tissue of the Fallopian tubes is entirely distinct from that of the uterus, from which he describes it as being separated by a distinct cellular septum. The mucous lining is thrown into a number of remarkable longitudinal folds, containing a dense and vascular fibrous septum, with small muscular fibres, and covered with columnar and ciliated epithelium. The apposition of these has the effect of producing a series of minute capillary tubes, along which the ovum is propelled, the action of the cilia, which is towards the uterus, apparently favoring its progress.

The *ovaries* are the bodies in which the ova are formed, and from which they are expelled, and the changes going on in them, in connection with the process of ovulation, during the whole period between the establishment of puberty and the cessation of menstruation, have an enormous influence on the female economy. Normally, the ovaries are two in number, although, in some exceptional cases, a supplementary ovary has been discovered; or they may be entirely absent. They are placed in the posterior fold of the broad ligament, usually below the brim of the pelvis, behind the Fallopian tubes, and on the left side in front of the rectum, on the right in front of some coils of the small intestine. Their situation varies, however, very much under different circumstances, so that they can scarcely be said to have a fixed and normal position. In pregnancy they rise into the abdominal cavity along with the increasing uterus, and in certain conditions they are dislocated downwards into Douglas's space, so that they may be felt through the vagina as rounded and very tender bodies.

The folds of the broad ligament, between which the ovaries are placed, form for them a kind of loose mesentery. Each of them is also united to the upper angle of the uterus by means of a special attachment called the utero-ovarian ligament. This is a rounded band of organic muscular fibres, continuous with the superficial muscular fibres of the posterior wall of the uterus, about an inch in length, and attached to the lateral border of the ovary. It is surrounded by peritoneum, and through it (as we shall see) the muscular fibres, which form an important integral part in the structure of the ovaries, are conveyed to them. The ovary is also attached to the fimbriated extremity of the Fallopian tube in the manner already described.

The ovary is of an irregular oval shape (Fig. 29), the upper border being convex, the lower—through which the vessels and nerves enter its structure—being straight. The anterior surface of the ovary, like that of the uterus, is flatter and less convex than the posterior. The outer extremity is more rounded and bulbous than the inner, which is more or less pointed and eventually lost in its proper ligament. By these peculiarities it is possible to distinguish the ovary of the left from that of the right side, after they have been removed from the body. It varies much in size under different circumstances. On an average, in adult life, it measures from one to two inches in length, ten lines in width, and about an inch in thickness. It increases greatly in size, however, during each menstrual period, a fact which has been demonstrated in certain cases of ovarian hernia, when the protruded ovary has been seen to swell as menstruation commenced; and also during pregnancy, when it is said to be double its usual size. After the change of life it atrophies, and becomes rough and wrinkled on its surface. Before puberty, the surface of the ovary is smooth and polished, and of a whitish color. After menstruation commences, however, its surface becomes scarred by the rupture of the Graafian follicles (Fig. 29, AA), each of which leaves a little linear or striated cicatrix, of a brownish color, and the older the patient the greater is the number of these cicatrices.

FIG. 29.

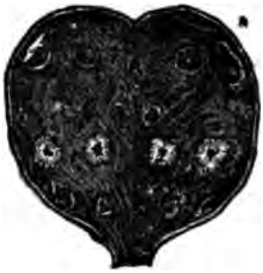


AA. Ovary enlarged under menstrual nisus. B. Ripe follicle projecting on its surface. a, a, a. Traces of previously ruptured follicles.

The *structure* of the ovary has been made the subject of many important observations. It has been generally described as consisting of an outer or peritoneal investment, a proper fibrous coat, known as the tunica albuginea, and a parenchyma or stroma. The correctness of this description has, however, been called in question by competent authorities. The peritoneal coat forms an incomplete covering to the ovary, not readily separable from it, and leaving at the inner border a free space, the hilum, at which the vessels and nerves enter. Waldeyer maintains that this investment is not strictly peritoneal, but that it is separated from the peritoneum at the base of the organ by a circular white line, and consists of columnar epithelium, differing only from the epithelium lining the Fallopian tubes, with which it is sometimes continuous through the attached fimbriæ uniting the tube and the ovary, in being destitute of cilia. Immediately beneath this covering is the dense coat known as the tunica albuginea, from its whitish color. It consists of short connective-tissue fibres, arranged in laminæ, among which are interspersed fusiform muscular fibres. At the point where the vessels and nerves enter the ovary this membrane is raised into a projecting ridge, which is continuous with the utero-ovarian ligaments. The *tunica albuginea* is intimately blended with the stroma of the ovary, so as to be inseparable from it on dissection; and according to most recent observers it does not exist as a distinct lamina, but is merely the external part of the proper structure of the ovary, in which more dense connective tissue is developed than in other parts.

On making a longitudinal section of the ovary (Fig. 30), it will be seen to be composed of two parts, the more internal of which is of a reddish color from the number of vessels that ramify in it, and is called the medullary or vascular zone, while the external, of a whitish tint, receives the name of the cortical or parenchymatous substance. The former consists of loose connective tissue interspersed with elastic fibres, and a considerable number of muscular fibres. According to Rouget[1] and His,[2] the muscular structure forms the greater part of the ovarian stroma. The latter describes it as consisting essentially of interwoven muscular fibres, which he terms the "fusiform tissue," and which he believes to be continuous with the muscular layers of the ovarian vessels. The former believes that the muscular fasciculi accompany the vessels in the form of sheaths, as in erectile tissues. Both attribute to the muscular structures of the ovary an important influence in the expulsion of the ova, and in the rupture of the Graafian follicles. Waldeyer and other writers, however, do not consider the muscular tissue of the ovaries to be so extensively developed as Rouget and His believe. The *cortical layer* is the most important, as that in which the Graafian follicles and ova are formed. It consists of interlaced fibres of connective tissue, containing a large number of interstitial nuclei. The muscular fibres of the medullary substance do not seem to penetrate into the cortical layer in man. In the cortical substance are found the Graafian follicles, which exist in it in enormous numbers from the earliest periods of life, and in all stages of development.

FIG. 30.



The Graafian Follicles.—According to the researches of Pflüger, Waldeyer, and other German writers, the Graafian follicles are formed in early fœtal life by cylindrical inflections of the epithelial covering of the ovary, which dip into the substance of the gland. These tubular filaments anastomose with each other, and in them are formed the ova, which are originally the epithelial cells lining the tubes. Portions become shut off from the rest of the filaments, and form the Graafian follicles. The ova, on this view, are in fact highly developed epithelial cells, originally derived from the surface of the ovary, and not developed in its stroma. These tubular filaments disappear shortly after birth, but they have recently been detected by Slavyansky[1] in the ovaries of a woman 30 years of age. These observations have been modified by Dr. Foulis, in a recent, and as yet unpublished, graduation thesis, communicated to the Royal Society of Edinburgh. He recognizes the origin of the ova from the germ-epithelium covering the surface of the ovary, which is itself derived from the Wolffian body. He believes all the ova to be formed from these germ-epithelium corpuscles, which become embedded in the stroma of the ovary, by the inward growth of processes of vascular connective tissue, fresh germ-epithelial corpuscles being constantly produced on the surface of the organ, up to the age of 2½ years, to take the place of those already embedded in its stroma. He believes the Graafian follicles to be formed by the growth of delicate processes of connective tissue between and around the ova, but not from tubular inflections of the epithelium covering the gland, as described by Waldeyer.

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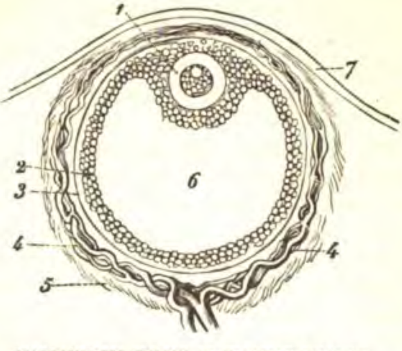
[1] Journal de Physiol., i. p. 737.
[2] Schultze's Arch. f. Mikroscop. Anat., 1865.

The greater proportion are only visible with the higher powers of the microscope, but those which are developing and approaching maturity are distinctly to be seen by the naked eye. The quantity of these follicles is immense. Foulis estimates that at birth each human ovary contains not less than 30,000. No fresh follicles, however, appear to be formed after birth, and as development goes on some only grow, and, by pressure on the others, their entire number is diminished. Of those that grow, of course only a few ever reach maturity, and they are scattered through the substance of the ovary, some developing in the stroma, others on the surface of the organ, where they eventually burst, as we

FIG. 31.



DIAGRAMMATIC SECTION OF GRAAFIAN FOLLICLE.

1. Ovum. 2. Membrana granulosa. 3. External membrane of Graafian follicle. 4. Its vessels. 5. Ovarian stroma. 6. Cavity of Graafian follicle. 7. External covering of ovary.

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[1] Annales de Gynec., Feb. 1871.

shall see in treating of ovulation and menstruation, and are discharged into the Fallopian tube.

Structure.—A ripe Graafian follicle has an external investing membrane, loosely connected to the ovarian stroma surrounding it (Fig. 31), from which it may be enucleated. It consists of two distinct layers; the external, or tunica fibrosa (the existence of which, however, is denied by Robin), is highly vascular and formed of connective tissue; the internal, or tunica propria, is composed of young connective tissue, containing a large number of fusiform or stellate cells, and numerous oil globules. Within this capsule is the epithelial lining called the membrana granulosa, consisting of stratified columnar epithelial cells. At one part of the circumference of the ovisac is situated the ovum itself, around which the epithelial cells are congregated in greater quantity, constituting the projection known as the discus proligerus. The remainder of the cavity of the follicle is filled with a small quantity of transparent fluid, the liquor folliculi, traversed by three or four minute bands, the retinacula of Barry, which are attached to the opposite surfaces of the follicular cavity, and apparently serve the purpose of suspending the ovum, and maintaining it in a proper position. In many young follicles, however, this cavity does not at first exist, and the follicle is entirely filled by the ovum itself. According to Waldeyer, the liquor folliculi is subsequently formed by the disintegration of the epithelial cells, the fluid thus produced collecting, and distending the interior of the follicle.

The *ovum* itself is attached to some part of the internal surface of the Graafian follicle. It is a rounded vesicle about $\frac{1}{180}$th of an inch in diameter, and is surrounded by a layer of columnar cells, distinct from those of the discus proligerus in which it lies. It is invested by a transparent membrane, the zona pellucida, or vitelline membrane, which is tough and elastic. In most of the lower animals the zona pellucida is perforated by numerous very minute pores, only visible under the highest powers of the microscope, and in others there is a distinct aperture of a larger size, the micropyle, serving for a passage for the spermatozoa into the interior of the ova. It is possible that similar arrangements may exist in the human ovum; but they have not been demonstrated. Within the zona pellucida some describe a second fine membrane, the existence of which has been denied by Bischoff. The cavity of the ovum is filled with a viscid yellow fluid, the yelk, containing numerous granules. It entirely fills the cavity, to the walls of which it is non-adherent, and in the centre of this yelk in young, and at some portion of its periphery in mature ova, is situated the germinal vesicle, which is a clear circular vesicle, refracting light strongly, and about $\frac{1}{80}$th of a line in diameter. It contains a few granules, and a nucleolus, or germinal spot, which is sometimes double.

From within outwards, therefore, we have:—

1. The *germinal* spot; round this
2. The *germinal* vesicle, contained in
3. The *yelk*, which is surrounded by the
4. *Zona pellucida*, with its layers of columnar epithelial cells.

These constitute the ovum.

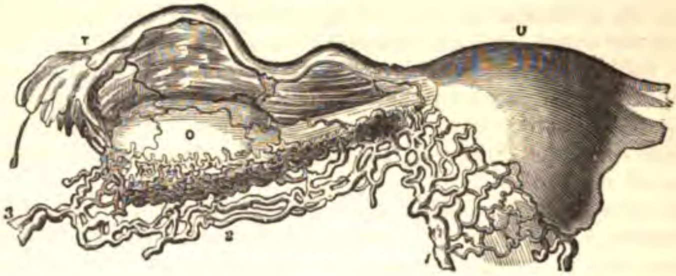
The ovum itself is contained in—

The *Graafian follicle*, and in that part of its epithelial lining called the—

Discus proligerus, the rest of the follicle being occupied by the *liquor folliculi*. Round this we have the epithelial lining or *membrana granulosa*, and the external coat, consisting of the *tunica propria* and the *tunica fibrosa*.

The vascular arrangements of the ovary are complex. The arteries enter at the hilum, whence they penetrate the stroma in a spiral curve, being ultimately distributed in a rich capillary plexus to the follicles. The large veins which collect the blood from them unite freely with each other, and form a vascular and erectile plexus, continuous with that surrounding the uterus, called the bulb of the ovary (Fig. 32). Lymphatics and nerves also exist, but their mode of termination is unknown.

FIG. 32.



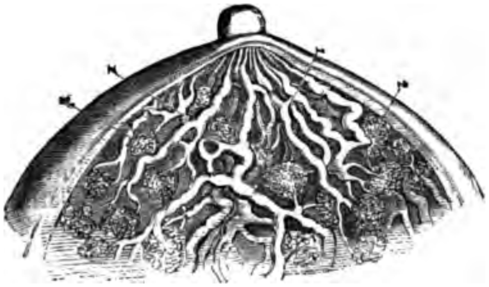
BULB OF OVARY.

u. Uterus. *o*. Ovary and utero-ovarian ligament. I. Fallopian tube. 1. Utero-ovarian vein. 2. Pampiniform ovarian plexus. 3. Commencement of spermatic vein.

To complete the consideration of the generative organs of the female we have to study the *mammary glands*, which secrete the fluid destined to nourish the child. In the human subject they are two in number, and instead of being placed over the abdomen, as in most animals, they are situated on either side of the sternum, over the pectoralis major muscles, and extending from the third to the seventh rib. This position of the glands is obviously intended to suit the erect position of the female in suckling. They are convex anteriorly, and flattened posteriorly, where they rest on the muscles. They vary greatly in size in different subjects, chiefly in proportion to the amount of adipose tissue they contain. In man, and in girls previous to puberty, they are rudimentary in structure, while in pregnant women they increase greatly in size, the true glandular secretory portions becoming much hypertrophied. Anomalies in shape and position are sometimes observed. Supplementary mammæ, one or more in number, situated on the upper portion of the mammæ, have been met with, identical in structure with the normally situated glands; and, more commonly, an extra nipple is observed by the side of the principal one. In some races, especially the African, the mammæ are enormously developed, so that the mother is able to suckle her child over her shoulder.

The skin covering the gland is soft and supple, and during pregnancy often becomes covered with fine white lines, while large blue veins may be observed coursing over. Underneath it is a quantity of connective tissue, containing a considerable amount of fat, which extends between the true glandular structure. This is composed of from fifteen to twenty lobes, each of which is formed of a number of lobules. These lobules are themselves produced by the aggregation of the terminal acini which constitute the true secretory structure in which the milk is formed. The acini are minute cul-de-sacs opening into little ducts, which unite with each other until they form a large duct for each lobule, the ducts of each lobule uniting with each other, until they end in a still larger duct common to each of the fifteen or twenty lobes into which the gland is divided, and eventually opening on the surface of the nipple. These terminal canals are known as the galactophorous ducts (Fig. 33). They become widely dilated as they approach the nipple, so as to form reservoirs in which milk is stored until it is required, but when they actually enter the nipple they again contract. Sometimes they give off lateral branches, but, according to Sappey, they do not anastomose with each other, as some anatomists have described. These excretory ducts are composed of connective tissue, with numerous elastic fibres on their external surface. Sappey and Robin also describe a layer of muscular fibres, chiefly developed near their terminal extremities. They are lined with a columnar epithelium, which is continuous with that in the acini, and it is by the distension of its cells with fatty matter, and their subsequent bursting, that the milk is formed.

FIG. 33.



1. Galactophorous ducts. 2. Lobuli of the mammary gland.

The *nipple* is the conical projection placed at the summit of the mamma, varying in size in different women. Not very unfrequently, from the continuous pressure to which it has been subjected by the dress, it is depressed below the surface of the skin, so as even to prevent lactation. It is generally larger in married than in single women, and increases in size during pregnancy. Its surface is covered with numerous papillæ, giving it a rugous aspect, and at their bases the orifices of the lactiferous ducts open. Here are also observed the openings of numerous sebaceous follicles, which secrete an unctuous material supposed to protect and soften the integument during lactation. Beneath the skin are found muscular fibres, mixed with connective and elastic tissues, vessels, nerves, and lymphatics. When the nipple is irritated it hardens and contracts, and by some this is referred to its erectile properties. The vascular arrangements, however, are not largely developed, and it contains no true erectile tissue, the hardening being due to muscular contraction. Surrounding the nipple is the *areola*, of a pink color in virgins, becoming dark from the development of pigment cells during pregnancy, and always remaining somewhat darker after childbearing. On its surface are a number of prominent tubercles, sixteen to twenty in number, which also become largely developed during gestation. They are supposed by some to secrete milk, and open into the lactiferous tubes; most probably they are composed of sebaceous glands only. Beneath the areola is a circular band of muscular fibres, the object of which is to compress the lactiferous tubes which run through it, and thus to favor the expulsion of their contents. The mammæ receive their blood-supply from the internal mammary and intercostal arteries, and they are richly supplied with lymphatic vessels, which open into the axillary glands. The nerves are derived from the intercostal and thoracic branches of the brachial plexus.

The secretion of milk in women who are nursing is accompanied by a peculiar sensation, as if milk were rushing into the breast, called the "draught," which is excited by the efforts of the child to suck, and by various other causes. The sympathetic relations between the mammæ and the uterus are very well marked, as is shown in the unimpregnated state by the fact of the frequent occurrence of sympathetic pains in the breast in connection with various uterine diseases, and, after delivery, by the well-known fact that suction produces reflex contraction of the uterus, and even severe after-pains.

CHAPTER III.

OVULATION AND MENSTRUATION.

Functions of the Ovary.—The main function of the ovary is to supply the female generative element, and not only to prepare it, but to expel it, when ready for impregnation, into the Fallopian tube, and thence into the uterus. This process takes place spontaneously in all viviparous animals, and without the assistance of the male. In the lower animals this periodical discharge receives the name of the œstrum or rut, at which period only the female is capable of impregnation, and this is the only time at which she admits the approach of the male. In the human female the periodical discharge of the ovum, in all probability, takes place in connection with menstruation, which may therefore be considered to be the analogue of the rut in animals. Between each menstrual period other Graafian follicles are undergoing changes which are preparing them for rupture and the discharge of their contained ova; and after this has taken place certain changes occur at the site of rupture which have for their object the healing of the rent in the ovarian tissue through which the ovum has escaped, and the filling up of the cavity in which it was contained. This results in the formation of a peculiar body in the substance of the ovary, called the corpus luteum, which is essentially modified should pregnancy occur, and which is of great interest and importance. During the whole of the childbearing period the periodical maturation and rupture of the Graafian follicles are going on. If impregnation does not take place, the ova are discharged and lost; if it does, ovulation is stopped, as a general rule, for the time, and also during lactation, when the woman is not fit for impregnation. This, broadly speaking, is a rough outline of the modern theory of menstruation, which was first broached in the year 1821 by Dr. Power, and subsequently elaborated by Negrier, Bischoff, Raciborski, and many other writers. Although the sequence of events here indicated may be taken to be the rule, it must be remembered that it is one subject to many exceptions, for undoubtedly ovulation may occur without its outward manifestation, menstruation, as in cases in which impregnation takes place in the absence of menstruation, either when that has never been established, of which many examples are recorded, or when pregnancy commences during lactation.

These exceptions have, indeed, led some modern writers to deny the ovular theory of menstruation altogether, and their views will require subsequent consideration.

In order to understand the subject properly, it will be necessary to study the sequence of events in detail.

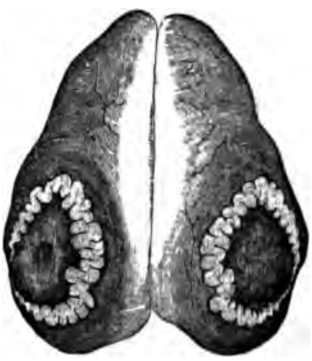
The *changes in the Graafian follicle* which are associated with the discharge of the ova comprise—1. *Maturation.* As the period of puberty approaches, a certain number of the Graafian follicles, fifteen to twenty in number, increase in size, and approach the periphery of the ovary. Amongst these one especially becomes developed, preparatory to rupture, and upon it for the time being all the vital energy of the ovary seems to be concentrated. A similar change in one, sometimes in more than one, follicle takes place periodically during the whole of the childbearing epoch, in connection with each menstrual period, and an examination of the ovary will show several follicles in different stages of development. The maturing follicle becomes gradually larger, until, at last, it forms a projection on the surface of the ovary, from five to seven lines in breadth, but sometimes even as large as a nut (Fig. 29, B). This growth is due to the distension of the follicle by the increase of its contained fluid, which causes it to press upon the ovarian structures covering it, so that these become thinned, separated from each other, and partially absorbed, until they eventually readily lacerate. The follicle also becomes greatly congested, the capillaries coursing over it become increased in size and loaded with blood, and these, being seen through the attenuated ovarian tissue, give the mature follicle a bright red color. At this time some of these distended capillaries in the inner coat of the follicle lacerate, and a certain quantity of blood escapes into its cavity. This escape of blood takes place before rupture, and seems to have for its principal object the increase of the tension of the follicle, of which it has been termed the menstruation. Pouchet was of opinion that the blood collects behind the ovum, and acts by carrying it up to the surface of the follicle. By these means the follicle is more and more distended, until at last it ruptures either spontaneously or, it may be, under the stimulus of sexual excitement. Whether the laceration takes place during, before, or after the period of the menstrual discharge is not yet positively known, although it is certain that the two events are intimately related. In order that the ovum may escape, the laceration must, of course, involve not only the coats of the Graafian follicles, but also the superincumbent ovarian structures. If, as Waldeyer and others believe, there is no tunica albuginea, and no true peritoneal coat to the ovary, but only a layer of epithelial cells, the facility with which they are torn may be readily understood.

Laceration seems to be aided by the growth of the internal layer of the follicle, which increases in thickness before rupture, and assumes a characteristic yellow color from the number of oil granules it then contains. It is also greatly facilitated, if it be not actually produced, by the turgescence of the important vascular arrangements in connection with the ovary at each menstrual period, and by the contraction of the muscular fibres which are found in the ovarian stroma. As soon as the rent in the follicular walls is produced, the ovum is discharged, surrounded by some of the cells of the membrana granulosa, and is received into the fimbriated extremity of the Fallopian tube, which grasps the ovary over the site of the rupture. By the vibratile cilia of its epithelial lining, it is then conducted into the canal of the tube, along which it is propelled, partly by ciliary action and partly by muscular contraction in the walls of the tube.

After the ovum has escaped, certain characteristic changes occur in the empty Graafian follicle, which have for their object its cicatrization and obliteration. There are great differences in the changes which occur when impregnation has followed the escape of the ovum, and they are then so remarkable that they have been considered certain signs of pregnancy. They are, however, differences of degree rather than of kind. It will be well, however, to discuss them separately.

As soon as the ovum is discharged, the edges of the rent through which it has escaped become agglutinated by plastic exudation, and the follicle itself shrinks, as is generally believed, by the inherent elasticity of its internal coat, but according to Robin, who denies the existence of this coat, from compression by the muscular fibres of the ovarian stroma. In proportion to the contraction that takes place, the inner granular layer of the follicle, the cells of which have become greatly hypertrophied and loaded with fat granules previous to rupture, is thrown into numerous folds and convolutions. The greater the amount of contraction, the deeper these folds become, giving to a section of the follicle an appearance similar to that of the convolutions of the brain (Fig. 34). These folds in the human subject are generally of a bright yellow color, although in some of the mammalia they are of

FIG. 84.



SECTION OF OVARY, SHOWING CORPUS LUTEUM THREE WEEKS AFTER MENSTRUATION.

a deep red. The tint was formerly ascribed by Raciborski to absorption of the coloring matter of the blood-clot contained in the follicular cavity, a theory he has more recently abandoned in favor of the view maintained by Coste, that it is due to the inherent color of the cells of the lining membrane of the follicle, which, though not well marked in a single cell, becomes very apparent *en masse.* The existence of a contained blood-clot is also denied by the latter physiologist, except as an unusual pathological condition; and he describes the cavity as containing a gelatinous and plastic fluid, colored with blood, which becomes absorbed as contraction advances. The folds into which the membrane has been thrown continue to increase in size, from the proliferation of its cells, until they unite together and become adherent, and eventually completely fill the follicular cavity. By the time that another Graafian follicle is matured and ready for rupture, the diminution has advanced considerably, and the empty ovisac is reduced to a very small size. The cavity is now nearly obliterated, the yellow color of the convolutions is altered into a whitish tint, and on section the corpus luteum has the appearance of a compact white stellate cicatrix, which generally disappears in less than forty days from the period of rupture. The tissue of the ovary at the site of laceration also shrinks, and this, aided by the contraction of the follicle, gives rise to one of those permanent pits or depressions which mark the surface of the adult ovary. Slavyansky[1] has recently shown that only a small proportion of the immense number of Graafian follicles contained in the ovary undergo these alterations. The greater proportion of them seem never to discharge their contained ova, but, after increasing in size, they undergo retrogressive changes exactly similar in their nature, but to a much less extent, to those which result in the formation of the corpus luteum. The site of these may afterwards be seen as minute striæ in the substance of the ovary.

Should pregnancy occur, all the changes above described take place, but, inasmuch as the ovary partakes of the stimulus to which all the generative organs are then subjected, they are much more marked and apparent. Instead of contracting and disappearing in a few weeks, the corpus luteum continues to grow until the third or fourth month of pregnancy, the folds of the inner layer of the ovisac becoming large and fleshy, and permeated by numerous capillaries, and ultimately becoming so firmly united that the margins of the convolutions thin and disappear, leaving only a firm fleshy yellow mass, averaging from 1 to 1½ inches in thickness, surrounding a central cavity, often containing a whitish fibrillated structure, believed to be the remains of a central blood-clot. This was erroneously supposed by Montgomery to be the inner layer of the follicle itself, and he conceived the yellow substance to be a new formation between it and the external layer, while Robert Lee thought it was placed external to both the external and internal layers.

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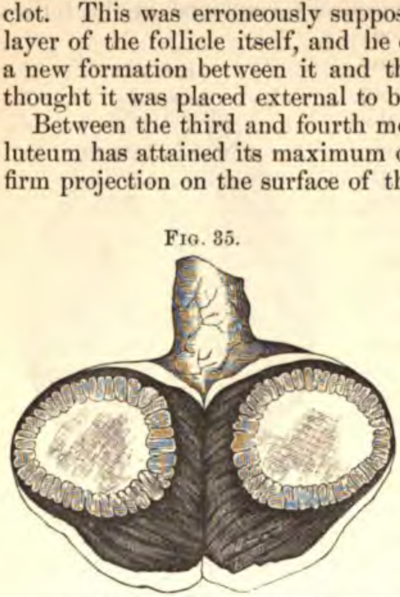
[1] Arch. de Phys., March, 1874.

Between the third and fourth months of pregnancy, when the corpus luteum has attained its maximum of development (Fig. 35), it forms a firm projection on the surface of the ovary, averaging about an inch in length, and rather more than half an inch in breadth. After this, however, it commences to atrophy (Fig. 36), the hypertrophied fat cells become absorbed, and the capillaries disappear. Complete cicatrization, however, does not take place until from one to two months after delivery.

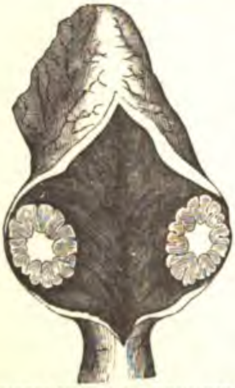
FIG. 35.



CORPUS LUTEUM AT THE FOURTH MONTH OF PREGNANCY.

On account of the marked appearance of the corpus luteum it was formerly considered to be an infallible sign of pregnancy; and it was distinguished from the corpus luteum of the non-pregnant state by being called a "true" as opposed to a "false" corpus luteum. From what has been said it will be obvious that this designation is essentially wrong, as the difference is one of degree only. Nor are obstetricians disposed to attach by any means the same importance as before to its presence as indicating impregnation; for, even when well marked, other and more reliable signs of recent delivery, such as the increased size of the uterus, are sure to be present, especially at the time when the corpus luteum has reached its maximum of development; while after delivery at term it has no longer a sufficiently characteristic appearance to be depended on.

FIG. 36.



CORPUS LUTEUM OF PREGNANCY AT TERM.

By the term *menstruation* (catamenia, periods, etc.) is meant a periodical discharge of blood from the uterus, occurring, in the healthy woman, every lunar month, except during pregnancy and lactation, when it is temporarily suspended.

Period of Establishment.—The first appearance of menstruation coincides with the establishment of puberty, and the physical changes that accompany it indicate that the female is capable of conception and childbearing, although exceptional cases are recorded in which pregnancy occurred before menstruation had begun. In temperate climates it generally commences between the 14th and 16th years, the largest number of cases, collected from the addition of numerous statistical tables,[1] being met with in the 15th year. This rule is, however, subject to many exceptions, it being by no means very rare for menstruation to become established as early as the 10th or 11th year, or to be delayed until the 18th or 20th. Beyond these physiological limits a few rare cases are from time to time met with in which it has begun in early infancy, or in which it has not shown itself until a comparatively late period of life.

Influence of Climate, Race, etc.—Various accidental circumstances have much to do with its establishment. As a rule, it occurs somewhat earlier in tropical, and later in very cold than in temperate climates. The influence of climate was formerly unduly exaggerated. It used to be generally stated that in the arctic regions women did not menstruate until they were of mature age, and that in the tropics girls of 10 or 12 years of age did so habitually. The researches of Dr. Robertson of Manchester[2] first showed that the generally received opinions on this subject were erroneous, and the collection of a large number of statistics has corroborated his opinion. There can be no doubt, however, that a larger proportion of girls menstruate early in warm climates. Joulin collected together from various sources 1635 cases from tropical climates, and found that the largest number of first menstruations occurred in the 12th and 13th years; so that there is an average difference of more than two years between the period of its establishment in the tropics and in temperate countries. Hains[3] also states that among the Hindoos 1 to 2 per cent. menstruate as early as nine years; 3 to 4 per cent. at ten; 8 per cent. at eleven; and 25 per cent. at twelve: while in London or Paris, probably not more than one girl in 1000 or 1200 does so at nine years. The converse holds true with regard to cold climates, although we are not in possession of a sufficient number of accurate statistics to draw very reliable conclusions on this point; but out of 4715 cases, including returns from Denmark, Norway and Sweden, Russia and Labrador, it was found that menstruation was established on an average a year later than in more temperate countries. It is probable that the mere influence of temperature has much to do in producing these differences, but there are other factors, the action of which must not be overlooked. Raciborski attributes considerable importance to the effect of race; and he has quoted Dr. Webb of Calcutta, to the effect that English girls in India, although subjected to the same climatic influence as the Indian races, do not, as a rule, menstruate earlier than in England; while in Austria, girls of the Magyar race menstruate considerably later than those of German parentage.[4] The surroundings of girls, and their manner of education and living, have probably also a marked influence in promoting or retarding its appearance. Thus, it will commence earlier in the children of the rich, who are likely to have a highly developed nervous organization, who are habituated to luxurious living, and a premature stimulation of the mental faculties by novel-reading, society, and the like; while amongst the hard-worked poor, or in girls brought up in the country, it is more likely to begin later. Premature sexual excitement is said also to favor its early appearance, and the influence of this among the factory-girls of Manchester, who are exposed, in the course of their work, to the temptations arising from the promiscuous mixing of the sexes, has been pointed out by Dr. Clay.[1]

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[1] Joulin, Traité d'Accouchements, p. 112.
[2] Edin. Med. and Surg. Journ., 1832.
[3] Amer. Journ. of Obst., 1871.
[4] Op. cit., p. 227.

Changes occurring at Puberty.—The first appearance of menstruation is accompanied by certain well-marked changes in the female system, on the occurrence of which we say that the girl has arrived at the period of puberty. The pubes become covered with hair, the breasts enlarge, the pelvis assumes the fully-developed female type, and the general contour of the body fills out. The mental qualities also alter; the girl becomes more shy and retiring, and her whole bearing indicates the change that has taken place. The menstrual discharge is not established regularly at once. For one or two months there may be only premonitory symptoms, a vague sense of discomfort, pains in the breasts, and a feeling of weight and heat in the back and loins. There then may be a discharge of mucus tinged with blood, or of pure blood, and this may not again show itself for several weeks. Such irregularities are of little consequence on the first establishment of the function, and need give rise to no apprehension.

Period of Duration and Recurrence.—As a rule, the discharge recurs every twenty-eight days, and with some women with such regularity that they can foretell its appearance almost to the hour. The rule is, however, subject to very great variations. It is by no means uncommon, and strictly within the limits of health, for it to appear every twentieth day, or even with less interval; while, in other cases, as much as six weeks may habitually intervene between the two periods. The period of recurrence may also vary in the same subject. I am acquainted with patients who sometimes have only twenty-eight days, at others as many as forty-eight days, between their periods, without their health in any way suffering. Joulin mentions the case of a lady who only menstruates two or three times in the year, and whose sister had the same peculiarity.

The duration of the period also is various in different women, and in the same woman at different times. In this country its average is four or five days, while Dubois and Brierre de Boismont fix eight days as its most usual length in France. Some women, however, are only unwell for a few hours, while in others it may last many days above the average without being considered abnormal.

The *quantity of blood lost* is very various in different women. Hippocrates puts it at ℥xviij, which, however, is much too high an estimate. Arthur Farre thinks that from ℥ij to ℥iij is the full amount of a healthy period, and that it cannot habitually exceed this without producing serious constitutional effects. Rich diet, luxurious living, and anything that unhealthily stimulates the body and mind will have an injurious effect in increasing the flow, which is, therefore, less in hard-worked countrywomen than in the better classes and residents in towns.

It is more abundant in warm climates, and our countrywomen in India habitually menstruate over-profusely, becoming less abundantly unwell when they return to England. Some women appear to menstruate more in summer than in winter. I am acquainted with a lady who spends the winter in St. Petersburg, where her periods last eight or ten days, and the summer in England, where they never exceed four or five. The difference is probably due to the effect of the over-heated rooms in which she lives in Russia.

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[1] Brit. Record of Obst. Med., vol. i.

The quantity lost daily is not the same during the continuance of the period. It generally begins slightly, gradually increasing so as to be most profuse on the second or third day, and as gradually diminishing. Towards the last days it sometimes disappears for a few hours, and then comes on again, and is apt to recur under any excitement or emotion.

Quality of Menstrual Blood.—As the menstrual fluid escapes from the uterus it consists of pure blood, and, if it be collected through the speculum, it coagulates in the usual way. The ordinary menstrual fluid does not coagulate unless it is excessive in amount. Various explanations of this fact have been given. It was formerly supposed either to contain no fibrine, or an unusually small amount. Retzius attributes its non-coagulation to the presence of free lactic and phosphoric acids. The true explanation was first given by Mandl, who proved that the admixture of even small quantities of pus or mucus in blood was sufficient to keep the fibrine in solution; and mucus is always present to greater or less amount in the secretions of the cervix and vagina, which mix with the blood in its passage through the genital tract. If the amount of blood is excessive, however, the mucus present is insufficient in quantity to produce this effect, and coagula are then formed.

On microscopic examination the menstrual fluid exhibits blood corpuscles, mucous corpuscles, and a considerable amount of epithelial scales, the débris of the epithelium lining the uterine cavity. According to Virchow, the form of these often proves that they come from the interior of the utricular glands. The color of the blood is at first dark, and as the period progresses it generally becomes lighter in tint. In women who are in bad health it is often very pale. These differences doubtless depend upon the amount of mucus mingled with it. The menstrual blood has always a peculiar characteristic, faint, and heavy odor, which is analogous to that which is so distinct in the lower animals during the rut. Raciborski mentions a lady who was so sensible to this that she could always tell to a certainty when any woman was menstruating. It is attributed to decomposition of the mucus mixed with the blood, which, when partially absorbed, may cause the peculiar odor of the breath often perceptible in menstruating women. This probably gave rise to the old and prevalent prejudices as to the deleterious properties of menstrual blood, which, it is needless to say, are altogether without foundation.

Source of the Blood.—It is now universally admitted that the source of the menstrual blood is the mucous membrane lining the interior of the uterus, for the blood may be seen oozing through the os uteri by means of the speculum, and in cases of prolapsus uteri; while in cases of inverted uterus it may be actually observed escaping from the exposed mucous membrane. During the menstrual nisus the whole mucous lining of the uterus becomes congested to such an extent that, in examining the bodies of women who have died during menstruation, it is found to be thicker, larger, and thrown into folds, so as to completely fill the uterine cavity. The capillary circulation at this time becomes very marked, and the mucous membrane assumes a deep red hue, the network of capillaries surrounding the orifices of the utricular glands being especially distinct. These facts have an unquestionable connection with the production of the discharge, but the precise mode in which the blood escapes from the vessels is not yet satisfactorily decided. Coste believed that the blood transudes through the coats of the capillaries without any laceration of their structure. The recent observations of Cohnheim have proved that the occurrence is quite possible, and his researches may yet find an application to menstruation, and prove the correctness of Coste's theory. Farre inclines to the hypothesis that the uterine capillaries terminate by open mouths, the escape of blood through these, between the menstrual periods, being prevented by muscular contraction of the uterine walls. Pouchet believed that in connection with each menstrual epoch the entire mucous membrane was broken down and cast off in the form of minute shreds, a fresh mucous membrane being developed in the interval between two periods. During this process the capillary network would be, of course, laid bare and ruptured, and the escape of blood readily accounted for. Tyler Smith, who adopted this view, states that he has frequently seen the uterine mucous membrane, in women who have died during menstruation, in a state of dissolution, with the broken loops of the capillaries exposed. The phenomena attending the so-called membranous dysmenorrhœa, in which the mucous membrane is thrown off in shreds, or as a cast of the uterine cavity, the nature of which was first pointed out by Simpson and Oldham, have been supposed to corroborate this theory. There is, however, no positive evidence that such exfoliation takes place under ordinary circumstances, although there can be no doubt of its occurrence as a morbid phenomenon. That the epithelial lining of the uterus is discharged may be taken as proved, for masses of epithelial cells may always be detected in the menstrual fluid, and this could hardly occur without the capillaries being laid bare. Whether, when this is effected, the blood escapes through minute lacerations of the exposed vessels, or by transudation through their coats, is a point requiring further elucidation. The escape of the blood, in whatever way it occurs, is doubtless favored by the peculiar erectile and vascular apparatus of the uterus and ovaries which has been so well described by Rouget, which is probably in a state of turgescence during the excitement of the menstrual nisus.

Theory of Menstruation.—The intimate connection between ovulation and menstruation is now admitted by most physiologists, and it is held that the determining cause of the discharge is the periodic maturation of the Graafian follicles. There is abundant evidence of this, for we know that when, at the change of life, the Graafian follicles cease to develop, menstruation is arrested; and when the ovaries are removed by operation, of which there are now numerous cases on record, or when they are congenitally absent, menstruation does not take place. A few cases, however, have been observed in which menstruation continued after double ovariotomy; and these have been used as an argument by those physiologists who doubt the ovular theory of menstruation. Slavyansky has particularly insisted on such cases, which, however, are probably susceptible of explanation. It may be that the habit of menstruation may continue for a time even after the removal of the ovaries, and it has not been shown that menstruation has continued permanently after double ovariotomy, although it certainly has occasionally, although quite exceptionally, done so for a time. It is possible, also, that in such cases a small portion of ovarian tissue may have been left unremoved, sufficient to carry on ovulation. Roberts, a traveller quoted by Depaul and Gueniot in their article on Menstruation in the "Dictionnaire des Sciences Médicales," relates that in certain parts of Central Asia it is the custom to remove both ovaries in young girls who act as guards to the harems. These women, known as hedjeras, subsequently assume much of the virile type, and never menstruate. The same close connection between ovulation and the rut of animals is observed, and supports the conclusion that the periodical oestrum and menstruation are analogous. The chief difference between ovulation in man and the lower animals is that in the latter the process is not generally accompanied by a sanguineous flow. To this, however, there are exceptions, for in monkeys there is certainly a discharge analogous to menstruation occurring at intervals. Another point of distinction is that in animals connection never takes place except during the oestrum, and that it is then only that the female is capable of conception; while in the human race conception only occurs in the interval between the periods. This is another argument brought against the ovular theory, because, it is said, if menstruation depends on the rupture of a Graafian follicle and the emission of an ovum, then impregnation should only take place during or immediately after menstruation. Coste explains this by supposing that it is the *maturation* and not the *rupture* of the follicle which determines the occurrence of menstruation; and that the follicle may remain unruptured for a considerable time after it is mature, the escape of the ovum being subsequently determined by some accidental cause, such as sexual excitement. However this may be, there is good reason to believe that the susceptibility to conception is greater in connection with the menstrual epochs. Raciborski believes that in the large proportion of cases impregnation occurs in the first half of the menstrual interval, or in the few days immediately preceding the appearance of the discharge. There are, however, very numerous exceptions, for in Jewesses, who almost invariably live apart from their husbands for eight days after the cessation of menstruation, impregnation must constantly occur at some other period of the interval, and it is certain that they are not less prolific than other people. This rule with them is very strictly adhered to, as will be seen by the accompanying interesting letter from a medical friend who is a well-known member of that community, and which I have permission to publish.[1]

[1] 10 BERNARD STREET, RUSSELL SQUARE, July 28, 1873.

MY DEAR SIR,

1. To the best of my knowledge and belief, the law which prohibits sexual intercourse amongst Jews for seven clear days after the cessation of menstruation is almost universally observed; the exceptions not being sufficient to vitiate statistics. The law has perhaps fewer exceptions on the Continent—especially Russia

This fact is of itself sufficient to disprove the theory advanced by Dr. Avrard,[1] that impregnation is impossible in the latter half of the menstrual interval. This, and the other reasons referred to, undoubtedly throw some doubt on the ovular theory, but they do not seem to be sufficient to justify the conclusion of Slavyansky, that menstruation forms a physiological process altogether independent of the development and maturation of the Graafian follicles. All that they can be fairly held to prove is that the escape of the ova may occur independently of menstruation; but the weight of evidence remains strongly in favor of the theory which is generally received.

Purpose of the Menstrual Loss.—The cause of the monthly periodicity is quite unknown, and will probably always remain so. The purpose of the loss of so much blood is also somewhat obscure. To a certain extent it must be considered an accident or complication of ovulation, produced by the vascular turgescence accompanying it. Nor is it essential to fecundation, because women often conceive during lactation, when menstruation is suspended, or before the function has become established. It may, however, serve the negative purpose of relieving the congested uterine capillaries which are periodically filled with a supply of blood necessary for the great growth which takes place when conception has occurred. Thus immediately before each period the uterus may be considered to be placed by the afflux of blood in a state of preparation for the function it may be suddenly called upon to perform. That the discharge relieves a state of vascular tension which accompanies ovulation is proved by the singular phenomenon of vicarious menstruation, which is occasionally, though rarely, met with. It occurs in cases in which, from some unexplained cause, the discharge does not escape from the uterine mucous membrane. Under such circumstances a more or less

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and Poland, where the Jewish population is very great—than in England. Even here, however, women who observe no other ceremonial law observe this, and cling to it after everything else is thrown overboard. There are doubtless many exceptions, especially among the better classes in England, who keep only three days after the cessation of the menses.

2. The law is—as you state—that should the discharge last only an hour or so, or should there be only one gush or one spot on the linen, the five days during which the period *might* continue are observed; to which must be superadded the seven clear days = twelve days per mensem in which connection is disallowed. Should any discharge be seen in the intermenstrual period, seven days would have to be kept, but not the five, for such *irregular* discharge.

3. The "bath of purification," which must contain *at least* eighty gallons, is used on the last night of the seven clear days. It is not used till after a bath for cleansing purposes: and from the night when such "purifying" bath is used, Jewish women are accustomed to calculate the commencement of pregnancy. That you should not have heard of it is not strange: its mention would be considered highly indelicate.

4. Jewish women reckon their pregnancy to last nine calendar or ten lunar months—270 to 280 days. There are no special data on which to reckon an average, nor do I know of any books on the subject, except some Talmudic authorities, which I will look up for you if you desire it. Pray make no apologies for writing to me: any information I possess is at your service.

I am, dear sir, yours very truly,

DR. PLAYFAIR. A. ASHER.

P.S. The Biblical foundation for the law of the seven clear days is Leviticus xv.,
verse 19 till the end of the chapter—especially verse 28.

[1] Rev. de Thérap. Med.-Chir., 1867.

regular escape of blood may take place from other sites, generally from either a mucous membrane or some part of the skin. The most common situations are the mucous membrane of the stomach, or of the nasal cavities, or of the lungs; or it may take place from the skin, not uncommonly that of the mammæ, probably on account of their intimate sympathetic relation with the uterine organs, or from the surface of an ulcer, or from hemorrhoids. It is a noteworthy fact that in all these cases it occurs in situations where the external escape of the blood can readily take place. The occurrence of this strange deviation of the menstrual discharge may be taken as a sign of general ill-health, and it usually is met with in delicate young women of highly mobile nervous constitution. It may, however, begin at puberty, and it has even been observed during the whole sexual life. The recurrence is regular, and always in connection with the menstrual nisus, although the amount of blood lost is much less than in ordinary menstruation.

Cessation of Menstruation.—After a certain time the ovaries and uterus undergo changes showing that the woman is no longer fitted for reproduction, and coincident with these menstruation ceases, Graafian follicles are no longer matured, and the ovary becomes shrivelled and wrinkled on its surface. Analogous alterations take place in the uterus and its appendages. The Fallopian tubes atrophy, and are not unfrequently obliterated. The uterus also decreases in size. The cervix undergoes a remarkable change which is readily detected on vaginal examination. The projection of the cervix into the vaginal canal disappears, and the orifice of the os uteri in old women is found to be flush with the roof of the vagina. In a large number of cases there is, after the cessation of menstruation, an occlusion both of the external and internal os; the canal of the cervix, however, between them remaining patulous, and not unfrequently being distended with a mucous secretion.

Period of Cessation.—The age at which menstruation ceases varies much in different women. In certain cases it may cease at an unusually early age, as between 30 and 40 years, or it may continue far beyond the average time, even up to 60 years; and exceptional, though perhaps hardly reliable, instances are recorded in which it has continued even to 80 or 90 years. These are, however, all strange anomalies, which, like cases of unusually precocious menstruation, cannot be considered as having any bearing on the general rule. Most cases of so-called protracted menstruation will be found to be really morbid losses of blood depending on malignant or other forms of organic disease, the existence of which, under such circumstances, should always be suspected.

In this country menstruation usually ceases between 40 and 50 years of age. Raciborski says that the largest number of cases of cessation are met with in the 46th year. It is generally said that women who commence to menstruate when very young, cease to do so at a comparatively early age, so that the average duration of the function is about the same in all women. Cazeaux and Raciborski, whose opinion is strengthened by the observations of Guy in 1500 cases,[1] think, on the contrary, that the earlier menstruation commences, the longer it lasts, early menstruation indicating an excess of vital energy which continues during the whole childbearing life. Climate and other accidental causes do not seem to have so much effect on the cessation as on the establishment of the function. It does not appear to cease earlier in warm than in temperate climates. The change of life is generally indicated by irregularities in the recurrence of the discharge. It seldom ceases suddenly, but it may be absent for one or more periods, and then occur irregularly, or it may become too profuse or scanty, until eventually it entirely stops. The popular notions as to the extreme danger of the menopause are probably much exaggerated, although it is certain that at that time various nervous phenomena are apt to be developed. So far from having a prejudicial effect on the health, however, it is not an uncommon observation to see an hysterical woman who has been for years a martyr to uterine and other complaints, apparently take a new lease of life when her uterine functions have ceased to be in active operation; and statistical tables abundantly prove that the general mortality of the sex is not greater at this than at any other time.

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[1] Med. Times and Gaz., 1845.

PART II.

PREGNANCY.

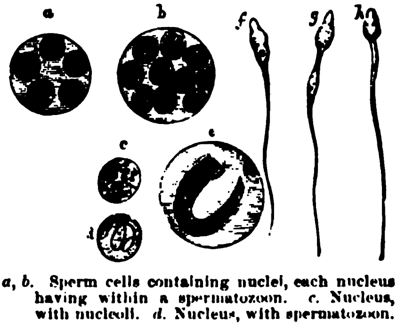
CHAPTER I.

CONCEPTION AND GENERATION.

GENERATION in the human female, as in all mammals, requires the congress of the two sexes, in order that the semen, the male element of generation, may be brought into contact with the ovum, the female element of generation, which has already been described.

The *semen* secreted by the testicle of an adult male is a viscid, opalescent fluid, forming an emulsion when mixed with water, and having a peculiar faint odor, which is attributed to the secretions which are mixed with it, such as those from the prostatic fluid and Cowper's glands. On analysis it is found to be an albuminous fluid, holding in solution various salts, principally phosphates and chlorides, and an animal substance, spermatine, analogous to fibrine. Examined under a magnifying power of from 400 to 500 diameters, it consists of a transparent and homogeneous fluid, in which are floating a certain number of granules and epithelial cells, derived from the secretions mixed with it, and the characteristic sperm cells and spermatozoa which form its essential constituents (Fig. 37). The sperm cells are large spherical vesicles, each containing from two to eight smaller cells, within which the spermatozoa are developed; and, as these soon escape and become free, the sperm cells are only to be detected in the testicles themselves, while in semen that has been ejaculated they are rarely visible. The large parent cell, termed by Robin the male ovule, forms within it several subsidiary cells by the segmentation of its granular contents. Within these secondary cells, or vesicles of evolution, as they are termed, which are believed by Kölliker

FIG. 37.



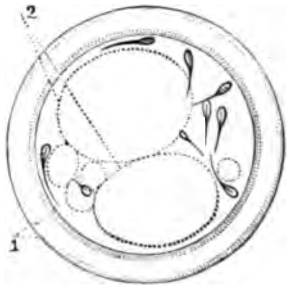
a, *b*. Sperm cells containing nuclei, each nucleus having within a spermatozoon. *c*. Nucleus, with nucleoli. *d*. Nucleus, with spermatozoon. *e*. A cell, with a bundle of spermatic filaments. *f*, *g*, *h*. Spermatozoa.

to be developed from the nuclei of the parent cell, the spermatozoa are formed, and before ejaculation they may be seen coiled spirally in their interior. The external envelope then disappears, and a number of spermatozoa, one being formed in each of the secondary cells, may sometimes be observed in the interior of the original parent cell. Eventually that also is absorbed, and the contained spermatozoa become liberated, and move about freely in the seminal fluid. As seen under the microscope, the spermatozoa, which exist in healthy semen in enormous numbers, present the appearance of minute particles not unlike a tadpole in shape. The head is oval and flattened, measuring about $\frac{1}{6000}$th of an inch in breadth, and attached to it is a delicate filamentous expansion or tail, which tapers to a point so fine that its termination cannot be seen by the highest powers of the microscope. The whole spermatozoon measures from $\frac{1}{400}$th to $\frac{1}{600}$th of an inch in length. They are observed to be in constant motion, sometimes very rapid, sometimes more gentle, which is supposed to be the means by which they pass upwards through the female genital organs. They retain their vitality and power of movement for a considerable time after emission, provided the semen is kept at a temperature similar to that of the body. Under such circumstances they have been observed in active motion from forty-eight to seventy-two hours after ejaculation, and they have also been seen alive in the testicle as long as twenty-four hours after death. In all probability they continue active much longer within the generative organs, as many physiologists have observed them in bitches and rabbits in full vitality, seven or eight days after copulation. Abundant leucorrhœal discharges and acrid vaginal secretions destroy their movements, and may thus cause sterility in the female. On account of their mobility, the spermatozoa were long considered to be independent animalcules, a view which is by no means exploded, and has been maintained in modern times by Pouchet, Joulin, and other writers, while Coste, Robin, Kölliker, etc., liken their motion to that of ciliated epithelium. There can be no doubt that the fertilizing power of the semen is due to the presence of the spermatozoa, although some of the older physiologists assigned it to the spermatic fluid. The former view, however, has been conclusively proved by the experiments of Prévost and Dumas, who found that on carefully removing the spermatozoa by filtration the semen lost its fecundating properties.

Sites of Impregnation.—There has been great difference of opinion as to the part of the genital tract in which the spermatozoa and the ovum come into contact, and in which impregnation, therefore, occurs. Spermatozoa have been observed in all parts of the female genital organs in animals killed shortly after coitus, especially in the Fallopian tubes, and even on the surface of the ovary itself. The phenomena of ovarian gestation, and the fact that fecundation has been proved to occur in certain animals within the ovary itself, tend to support the idea that it may also occur in the human female before the rupture of the Graafian follicle. In order to do so, however, it is necessary for the spermatozoa to penetrate the proper structure of the follicle and the epithelial covering of the ovary; and no one has actually seen them doing so. Most probably the contact of the spermatozoa and the ovum occurs very shortly after the rupture of the follicle, and in the outer part of the Fallopian tubes. Coste mentions that, unless the ovum is impregnated, it very rapidly degenerates after being expelled from the ovary, partly by inherent changes in the ovum itself, and partly because it then soon becomes invested by an albuminous covering which is impermeable to the spermatozoa. He believes, therefore, that impregnation can only occur either on the surface of the ovary, or just within the fimbriated extremity of the tube.

The semen is probably carried upwards chiefly by the inherent mobility of the spermatozoa. It is believed by some that this is assisted by other agencies; amongst them are mentioned the peristaltic action of the uterus and Fallopian tubes, a sort of capillary attraction effected when the walls of the uterus are in close contact, similar to the movement of fluid in minute tubes, and also the vibratile action of the epithelium of the uterine mucous membrane. The action of these in assisting ascent of the spermatozoa is extremely doubtful, for it is these very agencies which are supposed to effect the descent of the ovum, and they can hardly act in two opposite ways. The movement of the cilia is from within outwards; it would certainly oppose, rather than favor, the progress of the spermatozoa. It must, therefore, be admitted that they ascend chiefly through their own powers of motion. They certainly have this property to a remarkable extent, for there are numerous cases on record in which impregnation has occurred without penetration, and even when the hymen is quite entire, in which the semen has simply been deposited on the exterior of the vulva; and in such cases, which are far from uncommon, the spermatozoa must have found their way through the whole length of the vagina. The precise method in which the spermatozoa effect impregnation was long a matter of doubt. It is now, however, certain that they actually penetrate the ovum, and reach its interior. This has been conclusively proved by the observations of Barry, Meissner, and others, who have seen the spermatozoa within the external membrane of the ovum in rabbits (Fig. 38). In some of the invertebrata a canal or opening exists in the zona pellucida, through which the spermatozoa pass. No such aperture has yet been demonstrated in the ova of mammals, but their existence is far from improbable. According to the observations of Newport, several spermatozoa enter the ovum, and the greater the number that do so the more certain fecundation becomes. After the spermatozoa penetrate the zona pellucida they disintegrate and mingle with the yelk, having, while doing so, imparted to it a power of vitality and initiated its development into a new being.

FIG. 88.



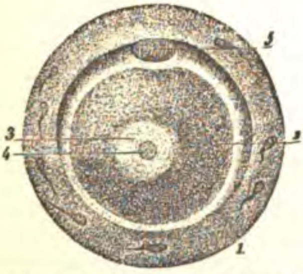
OVUM OF RABBIT CONTAINING SPERMATOZOA.

1. Zona pellucida. 2. The germs, consisting of two large cells, several smaller cells, and spermatozoa.

The length of time which elapses before the fecundated ovum arrives in the cavity of the uterus has not yet been ascertained, and it probably varies under different circumstances. It is known that in the bitch it may remain eight or ten days in the Fallopian tube, in the guinea-pig three or four. In the human female the ovum has never been discovered in the cavity of the uterus before the tenth or twelfth day after impregnation.

The changes which occur in the human ovum immediately before and after impregnation, and during its progress through the Fallopian tube, are only known to us by analogy, as, of course, it is impossible to study them from actual observation. We are in possession, however, of accurate information of what has been made out in the lower animals, and it is reasonable to suppose that similar changes occur in man. Immediately after the ovum has passed into the Fallopian tube, it is found to be surrounded by a layer of granular cells, a portion of the lining membrane of the Graafian follicle, which was described as the discus proligerus. As it advances along the tube, these surrounding cells disappear, partly, it is supposed, by friction with the walls of the tube, and partly by being absorbed to nourish the ovum at this stage of its existence, a function which some physiologists attribute to them. Be this as it may, before long they are no longer observed, and the zona pellucida itself forms the outermost layer of the ovum. When the ovum has advanced some distance along the tube, it becomes invested with a covering of albuminous material, which is deposited around it in successive layers, the thickness of which varies in different animals. It is very abundant in birds, in whom it forms the familiar white of the egg. In some animals it has not been detected, so that its presence in the human ovum is uncertain. Where it exists it doubtless contributes to the nourishment of the egg. Coincident with these changes is the disappearance of the germinal vesicle, which soon can no longer be detected. At the same time the contained yelk contracts and becomes more solid, retiring, in one spot, from close contact with the zona pellucida, and thus forming a species of cavity called by Newport "the *respiratory chamber*," which in some animals has been observed to be filled with a transparent liquid. After this occurs the very characteristic and peculiar phenomenon known as the cleavage of the yelk, which results in the formation of the membrane from which the fœtus is developed. This is preceded by the formation at one point of the surface of the yelk of a minute transparent globule of a bluish tint, sometimes of three or four separate globules which subsequently unite into one. This has received the name of the "*polar globule*" (Fig. 39), and seems to be formed from the hyaline substance of the yelk, from which it soon becomes entirely separated, and remains attached to the inner surface of the zona pellucida. It indicates the point at which the segmentation of the yelk begins, and where the cephalic extremity of the fœtus will subsequently be placed.

FIG. 39.

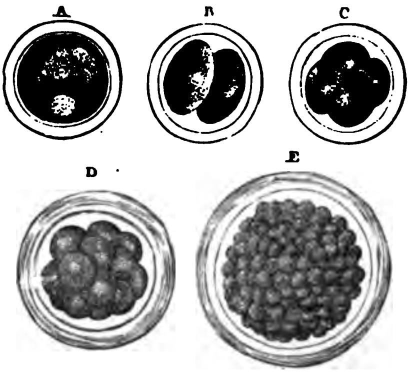


FORMATION OF THE "POLAR GLOBULE."

1. Zona pellucida, containing spermatozoa. 2. Yelk. 3 and 4. Germinal vesicle. 5. The polar globule.

According to Robin, these changes occur in all ova, whether they are impregnated or not, but if the ovum is not fecundated, no further alterations occur. Supposing impregnation has taken place, a bright clear vesicle, called the vitelline nucleus, very similar in appearance to a drop of oil, appears in the centre of the yelk. The segmentation of the yelk (Fig. 40) commences at the point where the polar globule is situated; it begins to divide into two halves, and at the same time the vitelline nucleus becomes constricted in its centre, and separated into two portions, one of which forms a centre for each of the halves into which the yelk has divided. Each of these immediately itself divides into two, as does its contained portion of the vitelline nucleus, and so on in rapid succession until the whole yelk is divided into a number of spheres, each of which contains its own portion of the vitelline nucleus.

FIG. 40

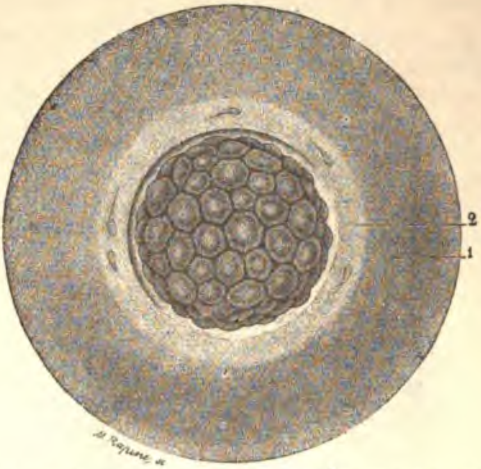


SEGMENTATION OF THE YELK.
A. Ovum with first embryo cell.
B. Division of embryo cell and cleavage of the yelk around it.
C, D, E Farther division of the yelk.

By these continuous dichotomous divisions the whole yelk is formed into a granular mass which, from its supposed resemblance to a mulberry, has been named the *muriform body*. When the subdivision of the yelk is completed, its separate spheres become converted into cells, consisting of a fine membrane with granular contents. These cells unite by their edges to form a continuous membrane (Fig. 41), which, through the expansion of the muriform body by fluid which forms its interior, is distended until it forms a continuous lining to the zona pellucida. This is in fact the *blastodermic membrane* from which the fœtus is developed. By this time the ovum has reached the uterus, and, before proceeding to consider the farther changes which it undergoes, it will be well to study the alteration which the stimulus of impregnation has set on foot in the mucous membrane of the uterus, in order to prepare it for the reception and growth of its contents.

Even before the ovum reaches the uterus its entire lining membrane becomes thickened and vascular, so that its opposing surfaces entirely fill the uterine cavity. These changes may be said to be the same in kind, although more marked and extensive in degree, as the alterations which are presumed to take place in the mucous membrane of the uterus in connection with each menstrual period. The result is the formation

FIG. 41.



FORMATION OF THE BLASTODERMIC MEMBRANE FROM THE CELLS OF THE MURIFORM BODY.

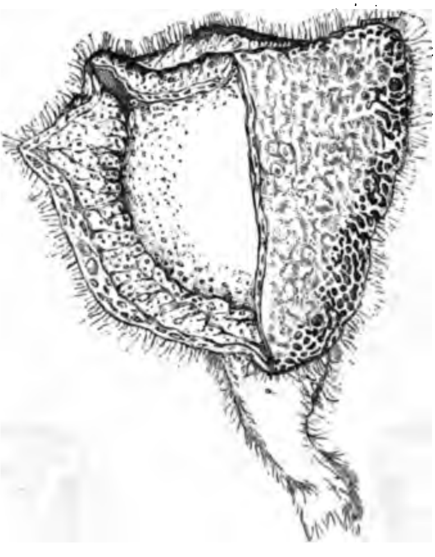
1. Layer of albuminous material surrounding. 2. The zona pellucida.

of a distinct membrane, which affords to the ovum a safe anchorage and protection, until its connections with the uterus are more fully developed. After delivery, this membrane, which is by that time quite altered in appearance, is at least partially thrown off with the ovum, on which account it has received the name of the *decidua*, or *caduca*. The decidua consists of two principal portions, which, in early pregnancy, are separated from each other by a considerable interspace. One of these, called the *decidua vera*, lines the entire uterine cavity, and is, no doubt, the original mucous lining of the uterus greatly hypertrophied. The second, the *decidua reflexa*, is closely applied round the ovum itself; and we shall presently see that it is probably formed by the sprouting of the decidua vera around the ovum at the point on which the latter rests, so that it eventually surrounds it completely. As the ovum expands, the newly-grown portion of mucous membrane is, of course, stretched by the increasing ovum, until it comes everywhere into contact with the decidua vera, with which it firmly unites. After the third month of pregnancy true union has occurred, and the two layers of decidua are no longer separate. The *decidua serotina*, which is described as a third portion, is merely that part of the decidua vera on which the ovum rests, and where the placenta is eventually developed.

It is needless to refer to the various views which have been held by anatomists as to the structure and formation of the decidua. The one taught by John Hunter was long believed to be correct, and down to a recent date it received the adherence of most physiologists. He believed the decidua to be an inflammatory exudation which, on account of the stimulus of pregnancy, was thrown out all over the cavity of the uterus and soon formed a distinct lining membrane to it. When the impregnated ovum reached the uterine orifice of the Fallopian tube, it found its entrance barred by this new membrane, which accordingly it pushed before it. This separated portion formed a covering to the ovum, and became the decidua reflexa, while a fresh exudation took place at that portion of the uterine wall which was thus laid bare, and this became the decidua vera. William Hunter, however, had much more correct views of the decidua, the accuracy of which was at the time much contested, but which have recently received full recognition and are now almost universally adopted. He describes the decidua in his earlier writings as an hypertrophy of the uterine mucous membrane itself, a view which is now held by nearly all physiologists.

Structure of the Decidua.—When the decidua is first formed it is a hollow triangular sac lining the uterine cavity (Fig. 42), and having three openings into it, those of the Fallopian tubes at its upper angles, and one, corresponding to the internal os uteri, below. If, however, as is generally the case, the membrane is thick and pulpy, these are closed up and can no longer be detected. In early pregnancy it is well marked and strongly developed, and continues to grow up to the third month of utero-gestation. After that time, however, it commences to atrophy, its adhesion with the uterine walls lessens, it becomes thin and transparent, and is ready for expulsion when delivery is effected. When it is most developed, a careful examination of the decidua enables us to detect in it all the elements of the uterine mucous membrane greatly hypertrophied. Its substance chiefly consists of large round or oval

FIG. 42.

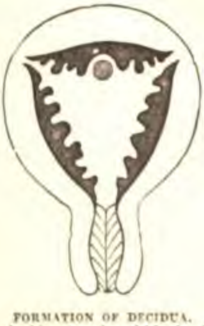


ABORTED OVUM OF ABOUT FORTY DAYS, SHOWING THE TRIANGULAR SHAPE OF THE DECIDUA (WHICH IS LAID OPEN), AND THE APERTURE OF THE FALLOPIAN TUBE.

nucleated cells and elongated fibres, mixed with the tubular uterine gland ducts, which are much elongated and filled with cylindrical epithelium cells and a small quantity of milky fluid. According to Friedlander, the decidua is divisible into two layers; the innermost being formed out of the connective tissue of the mucous membrane, the deeper-seated, in contact with the uterine walls, being formed out of flattened or compressed gland ducts. In an early abortion the extremities of these may be observed by a lens on the external or uterine surface of the decidua, occupying the summit of minute projections, separated from each other by depressions. If these projections are bisected they will be found to contain little cavities, filled with lactescent fluid, which were first described by Montgomery of Dublin, and are known as "Montgomery's cups." They are in fact the dilated canals of the uterine tubular glands. On the internal surface of such an early decidua a number of shallow depressions may be made out, which are the open mouths of these same ducts.

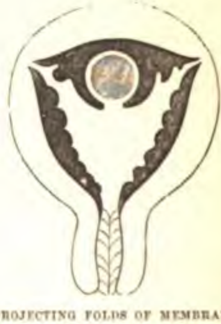
Formation of the Decidua Reflexa.—When the impregnated ovum reaches the uterine cavity it soon becomes imbedded in the folds of the hypertrophied mucous membrane, which almost entirely fills the uterine cavity. As a rule it is attached to some point near the opening of the Fallopian tube, the turgescence of the folds of mucous membrane preventing its descent to the lower part of the uterus; in exceptional circumstances, however, as in women who have borne many children and have a more than usually dilated uterine cavity, it may fix itself at a point much nearer the internal os uteri. According to the now generally received opinion of Coste, the mucous membrane at the base of the ovum soon begins to sprout around it, and gradually extends until it eventually completely covers the ovum (Figs. 43–45) and forms the decidua reflexa. Coste describes, under the name of the umbilicus, a small depression at the most prominent part of the ovum, which he considers to be the indication of the point where the complete junction of the developed decidua reflexa is effected. There are some objections to this theory, for no one has seen the decidua reflexa incomplete and

FIG. 43.



FORMATION OF DECIDUA.
(The decidua is colored black, the ovum is represented as engaged between two projecting folds of membrane.)

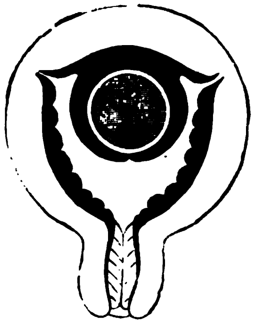
FIG. 44.



PROJECTING FOLDS OF MEMBRANE GROWING UP AROUND THE OVUM.

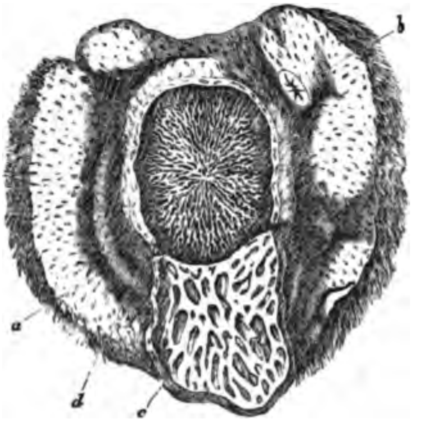
in the process of formation, and, on examining its external surface, that is, the one farthest from the ovum, its microscopical appearance is identical with that of the inner surface of the decidua vera. To meet these difficulties, Weber and Goodsir, whose views have been adopted by Priestley, contended that the decidua reflexa is "the primary lamina of the mucous membrane, which, when the ovum enters the uterus, separates in two-thirds of its extent from the layers beneath it, to adhere to the ovum; the remaining third remains attached, and forms a centre of nutrition." According to this view, the decidua vera would be a subsequent growth over the separated portion, and the decidua serotina the portion of the primary lamina which remained attached. In this way the fact of the opposed surfaces of the decidua vera and reflexa being identical in structure would be accounted for. The difficulty which this theory is intended to meet, however, does not seem so great as is supposed, for if, as is likely, it is only the epithelial or internal surface of the mucous membrane which sprouts over the ovum, and not its deeper layers, the facts of the case would be sufficiently met by Coste's view.

FIG 45.



SHOWING OVUM COMPLETELY SURROUNDED BY THE DECIDUA REFLEXA.

FIG. 46.



AN OVUM REMOVED FROM UTERUS, AND PART OF THE DECIDUA VERA CUT AWAY.
a. Decidua vera, showing the follicles opening on its inner surface. *b.* Inner extremity of Fallopian tube. *c.* Flap of decidua reflexa. *d.* Ovum.

Up to the third month of pregnancy the decidua reflexa and vera are not in close contact, and there may even be a considerable interspace between them, which sometimes contains a small quantity of mucous fluid, called by some the *hydroperione.* This fact may account for the curious circumstance, of which many instances are on record, that a uterine sound may sometimes be passed into a gravid uterus in the early months of pregnancy without necessarily producing abortion, and also for the occasional occurrence of menstruation after conception (Fig. 46). Eventually, by the growth of the ovum, the decidua reflexa comes closely into contact with the vera, so that the two become intimately blended and inseparable.

As pregnancy advances, the decidua alters in appearance and becomes fibrous and thin. In the later months of utero-gestation fatty degeneration of its structure commences, its vessels and glands become obliterated, and its adhesion to the uterine walls is lessened, so as to prepare it for separation. As we shall subsequently see, this fatty degeneration was assumed by Simpson to be the determining cause of labor at term.

It was long believed that the entire decidua was thrown off with the membranes after labor, leaving the muscular coat of the uterus bare and denuded, over which a new mucous membrane was formed during convalescence. According to Robin,[1] whose views are corroborated by Priestley, no such denudation of the muscular tissue of the uterus ever occurs, but a portion of the decidua always remains attached to the interior of the uterus after delivery. After the fourth month of pregnancy they believe that a new mucous membrane is formed under the decidua, which remains in a somewhat imperfect condition until after delivery, when it rapidly develops and assumes the proper functions of the mucous lining of the uterus. Robin also believes that that portion of the decidua which covers the placental site, the so-called decidua serotina, is not thrown off with the membranes, like the decidua vera and reflexa, but remains attached in its integrity to the uterine walls, a thin layer of it only being expelled with the placenta, on which it may be observed. Duncan,[2] however, entirely dissents from these views, and does not admit the formation of a new mucous membrane during the later months of utero-gestation. He believes, indeed, that the greater portion of the decidua is thrown off, but that part remains attached, and from this the fresh mucous membrane is developed. This view is similar to that of Spiegelberg, who believes that the portion of the decidua that is expelled is the more superficial of the two layers described by Friedlander, composed chiefly of the epithelial elements, while the deeper or glandular layer remains attached to the walls of the uterus. From the epithelium of the glands themselves a new epithelial layer is rapidly developed after delivery, to replace that expelled with the membranes. This theory bears on the well-known analogy of the uterus after delivery to the stump of an amputated limb; an old simile, principally based on the erroneous theory that the whole muscular lining of the uterus was laid bare. This, as we have seen, is not the case; but the simile so far holds good that the mucous lining is deprived of its epithelial covering, and this fact, together with the existence of numerous open veins on the interior of the uterus, readily explains the extreme susceptibility to septic absorption which forms so peculiar a characteristic of the puerperal state.

Changes in the Ovum.—Before we commenced the study of the decidua we had traced the impregnated ovum into the uterine cavity, and described the formation of the blastodermic membrane by the junction of the cells of the muriform body. We must now proceed to consider the further changes which result in the development of the fœtus, and of the membranes that surround it. It would be quite out of place in a work of this kind to enter into the subject of embryology at any length, and we must therefore be content with such details as are of importance from a practical point of view.

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[1] Mémoires de l'Acad. Imp. de Méd., 1861.

[2] Researches in Obstetrics, p. 186, *et seq.*

The blastodermic membrane, which forms a complete spherical lining to the ovum, between the yelk and the zona pellucida, soon divides into two layers, the most external, called the *serous*, and an internal, or *mucous*, layer, and between them is subsequently developed a third, or *vascular* layer. From these three spherical membranes is formed the entire fœtus; the serous layer giving origin to the bones, muscles, and integuments, the nervous system, the serous membranes, and the amnion; the mucous forming the mucous membranes and the alimentary canal; and the vascular the circulating system.

The Area Germinativa.—Almost immediately after the separation of the blastodermic membrane into layers, one part of it becomes thickened by the aggregation of cells, and is called the *area germinativa*. This is at first round and then oval in shape, and in its centre the first trace of the fœtus may be detected, in the form of a narrow straight line, the *primitive trace*. Surrounding it are some cells more translucent than those of the rest of the area germinativa, and hence called the *area pellucida* (Fig. 47). On each side of the primitive trace two elevated ridges soon arise, the *laminæ dorsales*, which gradually unite posteriorly so as to form a cavity within which the cerebro-spinal column is subsequently developed. Anteriorly they also join to form the thoracic and abdominal cavities, enclosing portions of the serous layer, from which the serous membranes of the body are developed. The minute embryo thus formed soon curves on itself, with its con-

FIG. 47.

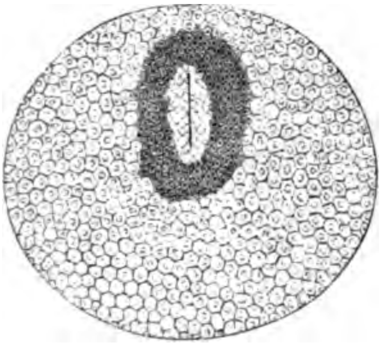
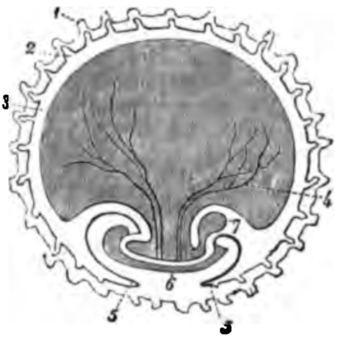


DIAGRAM OF AREA GERMINATIVA, SHOWING THE PRIMITIVE TRACE AND AREA PELLUCIDA.

FIG. 48.



DEVELOPMENT OF THE AMNION.

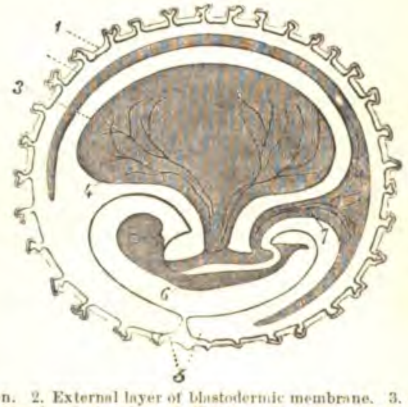
1. Vitelline membrane. 2. External layer of blastodermic membrane 3. Internal layers forming the umbilical vesicle. 4. Umbilical vessels. 5. Projections forming amnion. 6. Allantois.

vexity outwards, and a distinct thickening is observed at one end, which is subsequently developed into the cephalic extremity of the fœtus, while at its other end a thickening less marked in degree forms the caudal extremity.

Formation of the Amnion.—At each of these points, very soon after the formation of the embryo, the serous layer may be observed to project in the form of two hollow processes, which gradually arch over the dorsal surface of the fœtus, until they meet each other and form a complete serous envelope to it. At the ventral surface these processes are separated from each other by the whole length of the embryo, but they here also gradually approach each other, and eventually surround what is subsequently the umbilical cord, and blend with the integument of the fœtus at the point of its insertion. In this way is formed the *amnion* (Fig. 48), the most internal of the membranes enveloping the fœtus, which we shall presently study more in detail. It soon becomes distended with fluid, the *liquor amnii*, and as this increases in amount it separates the amnion more and more from the fœtus which it surrounds.

Changes in the Mucous Layer.—During this time the innermost or mucous layer of the blastodermic membrane is also developing two projections at either extremity of the fœtus, and these gradually approach each other anteriorly. As the mucous layer is in contact with the yelk, when these meet they have the effect of dividing the yelk into two portions. One, and the smaller of the two, forms eventually the intestinal canal of the fœtus; the other, and much the larger, contains the greater portion of the yelk, and forms the ephemeral structure known as the *umbilical vesicle*, from which the fœtus derives the greater portion of its nourishment at the early stage of its existence. Its communication with the abdominal cavity of the fœtus is through the constricted portion at the point of division called the *vitelline duct* (Fig. 49). An artery and vein, the *omphalo-mesenteric*, ramify on the vesicle and its duct.

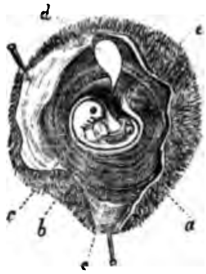
Fig. 49.



1. Exo-chorion. 2. External layer of blastodermic membrane. 3. Umbilical vesicle. 4. Its vessels. 5. Amnion. 6. Embryo. 7. Allantois increasing in size.

As the amnion increases in size, it pushes back the umbilical vesicle towards the external membrane of the ovum, between which and the amnion it lies (Fig. 50); and when the allantois, presently to be described, is developed, it ceases to be of any use, and rapidly shrinks and dwindles away. As a rule, no traces of it can be found after the fourth month of utero-gestation. The cavity of the umbilical vesicle is filled with a yellowish fluid, containing many oil and fat globules, similar to the yelk of an egg, which it represents.

FIG. 50.



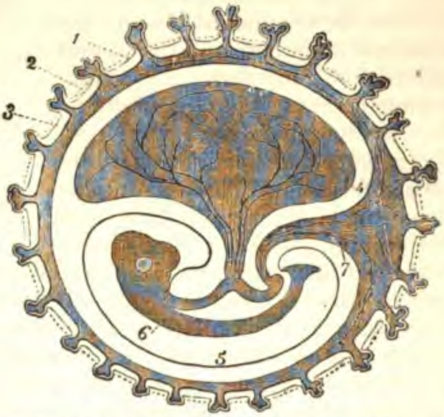
AN EMBRYO OF ABOUT TWENTY-FIVE DAYS LAID OPEN.

a. Chorion. *b*. Amnion.
f. Embryo.
c. Cavity of chorion.
d. Umbilical vesicle.
e. Pedicle of allantois.

The Allantois.—Somewhere about the twentieth day after conception a small vesicle is formed towards the caudal extremity of the fœtus, which is called the *allantois*. It is well developed and persistent in many of the lower animals, but in man it is merely a temporary structure, and disappears after it has fulfilled its functions. Its study, therefore, in the human race has been a matter of difficulty, and it was long before we were possessed of any very reliable information regarding it. There has been and is some difference of opinion as to its precise mode of origin. The most generally received opinion is that it begins as a diverticulum from the lower part of the intestinal canal, while others think that it may be first seen in the form of two solid elevations at the lower and anterior part of the fœtus, which unite and soon become hollowed into a vesicle; and that these are formed, not out of either layer of the blastodermic membranes, but from a separate mass of cells, like the heart and great vessels. The vesicle, at first spherical, rapidly develops and becomes pyriform in shape, while, by a process of constriction, similar to that which occurs in the vitellus to form the umbilical vesicle, it becomes divided into two parts, communicating with each other, the smaller of them being eventually developed into the urinary bladder. The larger portion, leaving the abdominal cavity along with the vitelline duct, rapidly grows until it comes into contact with the most external ovular membrane, the chorion, over the entire inner surface of which it spreads. In this part vessels soon develop themselves: namely, the two umbilical arteries, derived from the abdominal aorta, and two umbilical veins, one of which subsequently disappears; and these, along with the vitelline duct and the pedicle of the allantois, go to form the umbilical cord. The main and very important function of the allantois, therefore, is to carry the fœtal vessels up to the chorion, over the interior of which they spread, and enter the chorionic villi, part of which are subsequently developed into the placenta. Besides this purpose, the allantois, at a very early period, may receive the excretions of the fœtus, and serve as an excrementitious organ. According to Cazeaux, scarcely a trace of the allantois can be seen a few days after its formation. Its lower part, or pedicle, however, long remains distinct, and forms part of the umbilical cord, and traces of it may be found even in adult life in the form of the urachus, which really is the dwindled pedicle, and forms one of the ligaments of the bladder.

Between the chorion and amnion is often found a gelatinous fluid, with minute filamentous processes traversing it, called by Velpeau the *corps réticulé*, which is not met with until the allantois comes into contact with the chorion, and which seems to be formed out of the tissue of that vesicle. It is analogous to the so-called Wharton's jelly found in the umbilical cord. When first formed it is highly vascular, but the vessels entirely disappear after the placenta is formed, and the remainder of the chorionic villi atrophy. Sometimes it exists in considerable quantities, and should the chorion rupture at the end of pregnancy, it may escape and give rise to an erroneous impression that the liquor amnii has been discharged.

FIG. 51.



1. Exo-chorion. 2. External layer of the blastodermic membrane. 3. Allantois. 4. Umbilical vesicle. 5. Amnion. 6. Embryo. 7. Pedicle of allantois.

Before proceeding to consider the fœtal envelopes more at length, it may be useful to recapitulate the structures already alluded to as forming the early ovum. In this we find:—

1. The *embryo* itself.
2. A fluid, the *liquor amnii*, in which it floats.
3. The *amnion*, a purely fœtal membrane surrounding the embryo, and containing the liquor amnii.
4. The *umbilical vesicle*, containing the greater portion of the yelk, serving as a source of nutrition to the early embryo through the vitelline duct, and in which ramify the omphalo-mesenteric vessels.
5. The *allantois*, a vesicle proceeding from the caudal extremity of the embryo, spreading itself over the interior of the ovum, and serving as a channel of vascular communication between the chorion and the fœtus, through the umbilical vessels.
6. An interspace between the outer layer of the ovum and the amnion, in which are contained the *umbilical vesicle* and *allantois*, and the *corps réticulé* of Velpeau.
7. The outer layer of the ovum, along with the albuminous secretion with which it is covered, forming the *chorion* and *placenta*.

The *amnion* is the most internal of the two membranes surrounding the fœtus; its origin at an early period of fœtal life has already been described. It is a perfectly smooth, transparent, but tough membrane, continuous with the integument of the fœtus at the insertion of the umbilical cord, round which it forms a sheath. Soon after it is formed it becomes distended with a fluid, the *liquor amnii*, in which the fœtus is suspended and floats. This fluid increases gradually in quantity, distending the amnion as it does so, until this is brought into contact with the inner surface of the chorion, from which it was at first separated by a considerable interspace.

Structure.—The internal surface of the amnion is smooth and glistening, and on microscopic examination it is found to consist of a layer of flattened cells, each containing a large nucleus. These rest on a stratum of fibrous tissue which gives to the membrane its toughness, and by which it is attached to the inner surface of the chorion. It is entirely destitute of vessels, nerves, and lymphatics. The quantity of the liquor amnii varies much at different periods of pregnancy. In the early months it is relatively greater in amount than the fœtus, which it outweighs. As pregnancy advances, the weight of the fœtus becomes four or five times greater than that of the *liquor amnii*, although the actual quantity of fluid increases during the whole period of gestation. The amount of fluid varies much in different pregnancies. Sometimes there is comparatively little, while at others the quantity is immense, reaching several pounds in weight, greatly distending the uterus, and thus, it may be, producing difficulty in labor.

At first the liquid is clear and limpid. As pregnancy advances, it becomes more turbid and dense, from the admixture of epithelial débris derived from the cutaneous surface of the fœtus. In some cases, without actual disease, it may be dark green in color, and thick and tenacious in consistency; it has a peculiar heavy odor, and it consists chemically of water containing albumen, with various salts, principally phosphates and chlorides.

The *source of the liquor amnii* has been much disputed. Some maintain that it is derived chiefly from the fœtus, a view sufficiently disproved by the fact that the liquor amnii continues to increase in amount after the death or atrophy of the fœtus. Burdach believes that it is secreted by the internal surface of the uterus, and arrives in the cavity of the amnion by transudation through the membrane. Priestley—and this seems the most probable hypothesis—thinks that it is secreted by the epithelial cells lining the membrane, which become distended with fluid, burst, and pour their contents into the amniotic cavity.

Functions and Uses.—The most obvious use of the liquor amnii is to afford a fluid medium in which the fœtus floats, and so is protected from the shocks and jars to which it would otherwise be subjected, and from undue pressure from the uterine walls. By distending the uterus it saves the uterine walls from injury, which the movements of the fœtus might otherwise inflict, and the fœtus is thus also enabled to change its position freely. The facility with which version by external manipulation can be effected depends entirely on the mobility of the fœtus in the fluid which surrounds it. Some have also supposed that it prevents the fœtus, in the early months of pregnancy, from forming adhesions to the amnion. In labor it is of great service, by lubricating the passages, but chiefly by forming, with the membranes, a fluid wedge, which dilates or opens up the circle of the os uteri.

The *chorion* is the more external of the truly fœtal membranes, although external to it is the decidua, having a strictly maternal origin.

The chorion is a perfectly closed sac, its external surface, in contact with the decidua, being rough and shaggy from the development of villi (Fig. 50), its internal smooth and shining. As the ovum passes along the Fallopian tube, it receives, as we have seen, an albuminous coating, and this, with the zona pellucida, is developed into a temporary structure, the *primitive chorion*. On its external surface villous prominences soon appear, which have no ascertained structure, and which seem to nourish the early ovum by endosmotic absorption from the mucous membrane of the uterus. Some twelve days after conception, when the blastodermic membrane is formed, the *true chorion* appears. This is, in fact, formed by the external or serous layer of the blastodermic membrane, which everywhere lines the zona pellucida or primitive chorion, and, by pressure, causes its absorption and disappearance. On the surface of the true chorion thus formed, which is now the external envelope of the ovum, villi soon begin to appear.

Formation of the Villi.—These villi are hollow projections like the fingers of a glove, which are raised up from the surface of the chorion (the hollows looking into the chorionic cavity), and they cover the whole external surface of the ovum, so as to give it the peculiar shaggy appearance observed in early abortions. They push themselves into the substance of the decidua, with which they become soon so firmly united that they cannot be separated without laceration. At first they are absolutely non-vascular, but soon the allantois, previously described, reaches the inner surface of the chorion, and spreads itself over the whole of it. Each villus now receives a separate artery and vein, which gives off a branch to each of the subdivisions into which the villus divides. These vessels are encased in a fine sheath of the allantois, which enters the villus along with them and forms a lining to it, described by some as the *endo-chorion;* the external membrane of the villus, derived from the serous layer of the blastodermic membrane, being called the *exo-chorion*. The artery and vein lie side by side in the centre of the villus and anastomose at its extremity, each villus thus having a separate circulation.

Growth and Atrophy of the Villi.—As soon as the union of the allantois with the chorion has been effected, the villi grow very rapidly, give off branches, which, in their turn, give off secondary branches, and so form root-like processes of great complexity. In the early months of gestation they exist equally over the whole surface of the ovum. As pregnancy advances, however, those which are in contact with the decidua reflexa shrivel up and disappear, being no longer required for the nutrition of the ovum. The chorion and decidua thus come into close contact, being united together by fibrous shreds, which, on microscopic examination, even up to the end of pregnancy, are found to consist of the atrophied villi. A certain number of the villi, viz., those which are in contact with the decidua serotina, instead of dwindling away increase greatly in size, and eventually develop into the organ by which the fœtus is nourished—the *placenta*.

Form of the Placenta.—This important organ serves the purpose of supplying nutriment to, and aerating the blood of, the fœtus, and on its integrity the existence of the fœtus depends. It is met with in all mammals, but is very different in form and arrangement in different classes. Thus, in the sow, mare, and in the cetacea, it is diffused over the whole interior of the uterus; in the ruminants it is divided into a number of separate small masses, scattered here and there over the uterine walls; while in the carnivora it forms a zone or belt round the uterine cavity. In the human race the placenta is in the form of a circular mass, attached generally to some part of the uterus near the orifices of the Fallopian tubes, but it may be situated anywhere in the uterine cavity, even over the internal os uteri. As it is expelled after delivery with the fœtal membranes attached to it, and as the aperture in these corresponds to the os uteri, we can generally determine pretty accurately the situation in which the placenta was placed by examining them after expulsion. The maternal surface of the placenta is somewhat convex, the fœtal concave. Its size varies greatly in different cases, and it is usually largest when the child is big, but not necessarily so. Its average diameter is from 6 to 8 inches, its weight from 18 to 24 oz., but in exceptional cases it has been found to weigh several pounds. Abnormalities of form are not very rare. Thus, the placenta has been found to be divided into two distinct parts, a form said by Professor Turner to be normal in certain genera of monkeys; or smaller supplementary placentæ (placentæ succentariæ) may exist round a central mass. These variations of shape are only of importance in consequence of a risk of part of the detached placenta being left in utero after delivery and giving rise to septicæmia or secondary hemorrhage. The fœtal membranes cover the whole fœtal surface of the placenta, being reflected from its edges so as to line the uterine cavity, and being expelled with it after delivery. They also leave it at the insertion of the cord, to which they form a sheath. The cord is generally attached near the centre of the placenta, and from its insertion the umbilical vessels may be seen dividing and radiating over the whole fœtal surface.

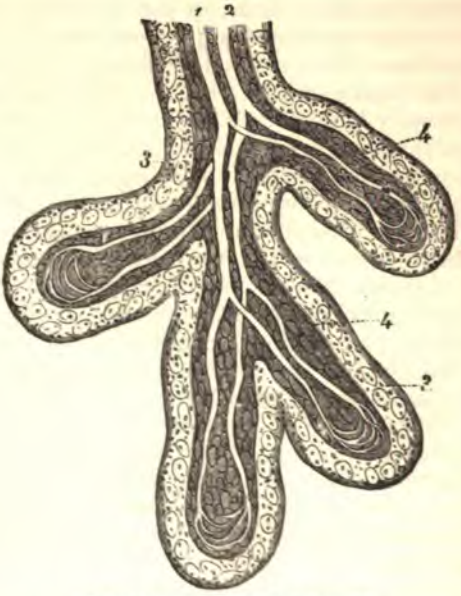
The *maternal surface* is rough and divided by numerous sulci, which are best seen if the placenta is rendered convex, so as to resemble its condition when attached to the uterus. A careful examination shows that a delicate membrane covers the entire maternal surface, unites the sulci together, and dips down between them. This is, in fact, the cellular layer of the decidua serotina, which is separated and expelled with the placenta, the deeper layer remaining attached in utero. Numerous small openings may be seen on the surface, which are the apertures of the veins torn off from the uterus, as also those of some arteries, which, after taking several sharp turns, open suddenly into the substance of the organ.

As regards the *minute structure of the placenta*, it is certain that it consists essentially of two distinct portions, one *fœtal*, consisting of the greatly hypertrophied chorionic villi, with their contained vessels, which carry the fœtal blood so as to bring it into intimate relation with the maternal blood, and thus admit of the necessary changes occurring in it connected with the nutrition of the fœtus; and the other *maternal*, formed out of the decidua serotina and the maternal blood-vessels.

These two portions are in the human female so intimately blended as to form the single deciduous organ which is thrown off after delivery. These main facts are admitted by all, but considerable differences of opinion still exist among anatomists as to the precise arrangement of these parts. In the following sketch of the subject I shall describe the views most generally entertained, merely briefly indicating the points which are contested by various authorities.

The *fœtal portion of the placenta* consists essentially of the ultimate ramifications of the chorion villi, which may be seen on microscopic examination in the form of club-shaped digitations which are given off at every possible angle from the stem of a parent trunk, just like the branches of a plant. Within the transparent walls of the villi the capillary tubes of the contained vessels may be seen lying, distended with blood, and presenting an appearance not unlike loops of small intestine. These capillaries are the terminal ramifications of the umbilical arteries and veins, which, after reaching the site of the placenta, divide and subdivide until they at last form an immense number of minute capillary vessels, with their convexities looking towards the maternal portion of the placenta, each terminal loop being contained in one of the digitations of the chorionic villi. Each arterial twig is accompanied by a corresponding venous branch, which unites with it to form the terminal arch or loop (Fig. 52). The fœtal blood is carried through these arterial twigs to the villi, where it comes into intimate

FIG. 52.

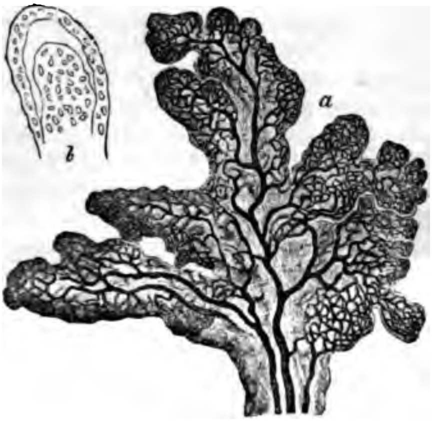


PLACENTAL VILLUS, GREATLY MAGNIFIED.

1, 2. Placental vessels, forming terminal loops. 3. Chorion tissue, forming external walls of villus. 4. Tissue surrounding vessels.

contact with the maternal blood, in consequence of the anatomical arrangements presently to be described; but the two do not directly mix, as the older physiologists believed, for none of the maternal blood escapes when the umbilical cord is cut, nor can the minutest injections through the fœtal vessels be made to pass into the maternal vascular system, or vice versâ. In addition to the looped terminations of the umbilical vessels, Farre and Schroeder van der Kolk have described another set of capillary vessels in connection with each villus (Fig. 53).

FIG. 53.



a. Terminal villus of fœtal tuft, minutely injected. b. Its nucleated non-vascular sheath.

This consists of a very fine network covering each villus, and very different in appearance from the convoluted vessels lying in its interior, which are the only ones which have been usually described. Dr. Farre believes that these vessels only exist in the early months of pregnancy, and that they subsequently disappear as pregnancy advances. Priestley[1] suggests that they may not be vessels at all, but lymphatics, which may possibly absorb nutrient material from the mother's blood and throw it into the fœtal vascular system. The existence of lymphatics or nerves in the placenta, however, has never been demonstrated, and they are believed not to exist.

Maternal Portion of the Placenta.—As generally described, the maternal portion of the placenta consists of large cavities, or of a single large cavity, which contains the maternal blood, and into which the villi of the chorion penetrate (Fig. 54). Into this maternal part of the viscus the curling arteries of the uterus pour their blood, which is collected from it by the uterine sinuses. The villi of the chorion, therefore, are suspended in a sac filled with maternal blood, which penetrates freely between them and is brought into very intimate contact with them. Dr. John Reid believed that only the delicate internal lining of the maternal vessels entered the substance of the placenta to form the sac just spoken of. Into this the villi project, pushing before them the membrane forming the limiting wall of the placental sinuses, each of them in this way receiving an investment, just as the fingers of a hand are covered by a glove (Fig. 55).

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[1] The Gravid Uterus, p. 52.

FIG. 54.

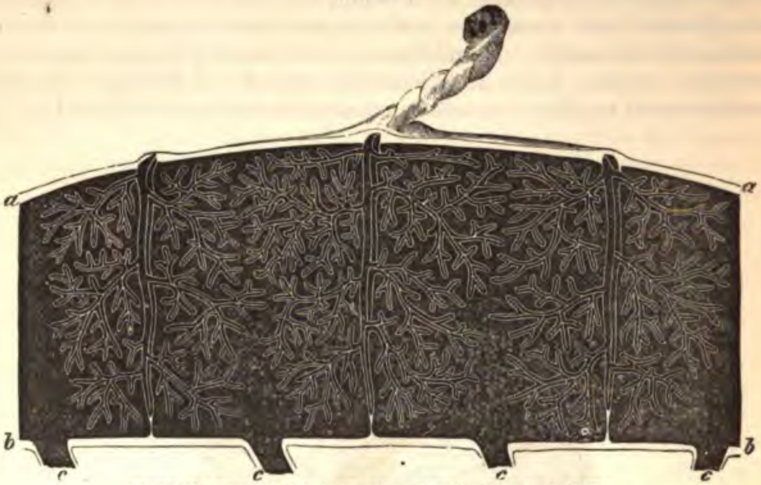

DIAGRAM REPRESENTING A VERTICAL SECTION OF THE PLACENTA.
a, a. Chorion. *b, b.* Decidua. *c, c, c, c.* Orifices of uterine sinuses.

This view is partially corroborated by Professor Turner,[1] who found, however, that all the chorion villi do not receive this investment, as Reid described. Schroeder van der Kolk and Goodsir (Fig. 56) were of opinion that not only were the maternal blood-vessels continued into the substance of the placenta, but also into the processes of the decidua, which accompanied the vessels and were prolonged over each villus so as to separate it from the limiting membrane of the maternal sinuses. Each villus would thus be covered with two layers of fine tissue, one from the internal lining membrane of the maternal blood-vessels, the other from the epithelial cells of the decidua.

FIG. 55.

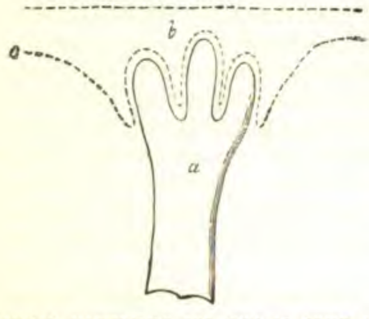

DIAGRAM ILLUSTRATING THE MODE IN WHICH A PLACENTAL VILLUS DERIVES A COVERING FROM THE VASCULAR SYSTEM OF THE MOTHER.
a. Villus having three terminal digitations projecting into *b.* Cavity of the mother's vessel. *c.* Dotted lines representing coat of vessel.

Farre, however, does not think the decidua passes into the placenta in the manner described, but that the blood directly bathes the chorion villi without any such limitation. The result, however, is the same whichever view is adopted, for in each case the villi will project freely into the mother's blood, which circulates around them on every side.

The existence of the maternal sinus system in the placenta is altogether denied by anatomists of eminence whose views are worthy of careful consideration. Prominent amongst these is Dr. Braxton Hicks,[1] who has lately written an elaborate paper on the subject. He holds that there is no evidence to prove that the maternal blood is poured out into a cavity in which the chorion villi float, and he believes that the curling arteries, instead of entering the so-called maternal portion of the placenta, terminate in the decidua serotina. The hypertrophied chorion villi at the site of the placenta are firmly attached to the decidual surface, into which their tips are imbedded. The line of junction between the decidua reflexa and serotina forms a firm circumferential margin to, and limits, the placenta. The arrangement of the fœtal portion of the placenta on this view is very similar to that generally described, but the villi are not surrounded by maternal blood at all, and nothing exists between them, unless it be a small quantity of serous fluid. The change in the fœtal blood is effected by endosmosis, and Hicks suggests that the follicles of the decidua may secrete a fluid, which is poured into the intervillous spaces for absorption by the villi.

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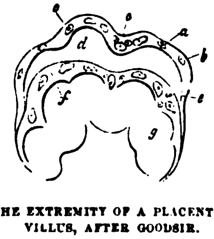
[1] Jour. of Anat. and Phys., vol. vii.

FIG. 56.



THE EXTREMITY OF A PLACENTAL VILLUS, AFTER GOODSIR.

a. External membrane of villus (the lining membrane of vascular system of Weber).
b. External cells of villus derived from decidua.
c, *c*. Nuclei of ditto.
d. The space between the maternal and fœtal portions of villus.
e. Its internal membrane.
f. Its internal cells.
g. The loop of umbilical vessels.

A view not very dissimilar to this has recently been advanced by Professor Ercolani of Bologna, who maintains that the maternal portion of the placenta is a new formation, strictly glandular, and not vascular, in its structure. It is formed, he thinks, by the submucous connective tissue of the decidua serotina, and it dips down into the placenta and forms a sheath to each of the chorion villi, which it separates from the maternal blood. This new glandular structure he describes as secreting a fluid, termed the "uterine milk," which is absorbed by the villi of the chorion, just as the mother's milk is absorbed by the villi of the intestines, and it is with this fluid alone that the chorion villi are in direct contact. The sheath thus formed to each villus is doubtless analogous to the layer of cells which Goodsir described as encasing each villus, but is attributed to a new structure formed after conception.

Both these views have been recently examined by Professor Turner[2] in his monographs on the placentation of the cetacea and of the sloths, as well as in his paper on the anatomy of the human placenta already referred to. By carefully performed injections with fine gelatine he satisfied himself of the correctness of the common or Hunterian theory of the formation of the maternal portion of the placenta, and of the existence of the sinus system of blood-vessels, and he found an analogous, although not identical, arrangement in the sloth. With regard to the theory of Ercolani, that the nutrition of the fœtus takes place by means of a uterine milk secreted by a newly-formed glandular organ, he brings forward evidence to prove that, though such a fluid is formed in the ruminants, yet in those animals, including the human female, in whom maternal sinuses are developed, no such secretion is necessary, and no growth or development of the utricular glands occurs; the nutritive changes, in all probability, taking place directly between the fœtal and maternal blood.

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[1] Obs. Trans., vol. xiv.

[2] Trans. Roy. Soc. Edin., vols. xxvi. and xxvii.

Functions of the Placenta.—It will thus be seen that anatomists of repute are still undecided as to important points in the minute anatomy of the placenta, which further investigation will doubtless clear up. The main functions of the organ are, however, sufficiently clear. During the entire period of its existence it fills the important office of both stomach and lungs to the fœtus. Whatever view of the arrangement of the maternal blood-vessels be taken, it is certain that the fœtal blood is propelled by the pulsations of the fœtal heart into the numberless villi of the chorion, where it is brought into very intimate relation with the mother's blood, gives off its carbonic acid, absorbs oxygen, and passes back to the fœtus, through the umbilical veins, in a fit state for circulation. The mode of respiration, therefore, in the fœtus is analogous to that in fishes, the chorion villi representing the gills, the maternal blood the water in which they float. Nutrition is also effected in the organ, and, by absorption through the chorion villi, the pabulum for the nourishment of the fœtus is taken up. It also probably serves as an emunctory for the products of excretion in the fœtus. Picard and Hass found that the blood in the placenta contained an appreciably larger quantity of urea than that in other parts of the body, this urea probably being derived from the fœtus. Claude Bernard also attributed to it a glycogenic function,[1] supposing it to take the place of the fœtal liver until that organ was sufficiently developed.

Changes previous to Expulsion.—Finally, we find that the temporary character of the placenta is indicated by certain degenerative changes which take place in it previous to expulsion. These consist chiefly in the deposit of calcareous patches on its uterine surface, and in fatty degeneration of the villi, and of the decidual layer between the placenta and the uterus. If this degeneration be carried to excess, as is not unfrequently the case, the fœtus may perish from a want of a sufficient number of healthy villi through which its respiration and nutrition may be effected.

The *umbilical cord* is the channel of communication between the fœtus and placenta, being attached to the former at the umbilicus, to the latter generally near its centre, but sometimes, as in the battledore placenta, at its edge. It varies much in length, measuring on an average from eighteen to twenty-four inches, but in exceptional cases being found as much as fifty or sixty long, and as short as five or six inches.

When fully formed, it consists of an external membranous layer formed of the amnion, two umbilical arteries, one umbilical vein, and a considerable quantity of transparent gelatinous substance surrounding the vessels, called Wharton's jelly, which is contained in a fine network of fibres and is formed out of the tissue of the allantois. At an early period of pregnancy, in addition to these structures, the cord contains the pedicle of the umbilical vesicle, with the omphalo-mesenteric vessels ramifying on it, and two umbilical veins, one of which soon atrophies and disappears. No nerves or lymphatics have been satisfactorily demonstrated in the cord, although such have been described as existing. The vessels of the cord are at first straight in their course, but shortly they become greatly twisted, the arteries being external to the vein, and in nine cases out of ten the twist being from left to right. Various explanations have been given of this peculiarity, none of them entirely satisfactory. Tyler Smith attributed it to the movements of the fœtus twisting the cord, its attachment to the placenta being a fixed point; this would not, however, account for the frequency with which the spiral turns occur in one direction. Mr. John Simpson attributed it to the greater pressure of the blood through the right hypogastric artery, on account of that vessel having a more direct relation to the aorta than the left. The umbilical arteries give off no branches, and the vein contains no valves, nor can any vasa vasorum be detected in their coats after they have left the umbilicus. The umbilical arteries increase in size after they leave the cord, to divide on the surface of the placenta. This is the only example in the body in which arteries are larger near their terminations than their origin, and the object of this arrangement is probably to effect a retardation of the current of the blood distributed to the placenta. The tortuous course of the vein probably compensates for the absence of valves, and moderates the flow of blood through it. Distinct knots are not unfrequently observed in the cord, but they rarely have the effect of obstructing the circulation through it. They no doubt form when the fœtus is very small. They may sometimes also be produced in labor by the child being propelled through a coil of the cord lying circularly round the os uteri. The so-called false knots are merely accidental nodosities due to local enlargements of the vessels.

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[1] Acad. des Sciences, April, 1859.

CHAPTER II.

THE ANATOMY AND PHYSIOLOGY OF THE FŒTUS.

It is obviously impossible to attempt anything like a full account of the development of the various fœtal structures, or of their growth during intra-uterine life. To do so would lead us far beyond the scope of this work, and would involve a study of complex details only suitable in a treatise on Embryology. It is of importance, however, that the practitioner should have it in his power to determine approximatively the age of the fœtus in abortions or premature labor, and for this purpose it is necessary to describe briefly the appearance of the fœtus at various stages of its growth.

1st Month.—The fœtus in the first month of gestation is a minute, gelatinous, and semi-transparent mass, in which no definite structure can be made out, and in which no head or extremities can be seen. It is rarely to be detected in abortions, being lost in surrounding blood-clots. In the few examples which have been carefully examined it did not measure more than a line in length. It is, however, already surrounded by the amnion, and the pedicle of the umbilical vesicle can be traced into the unclosed abdominal cavity.

2d Month.—The embryo becomes more distinctly apparent, and is curved on itself, weighing about 62 grains, and measuring six or eight lines in length. The head and extremities are distinctly visible—the latter in the form of rudimentary projections from the body. The eyes are to be seen as small black spots on the side of the head. The spinal column is divided into separate vertebræ. The independent circulatory system of the fœtus is now beginning to form, the heart consisting of only one ventricle and one auricle, from the former of which both the aorta and pulmonary arteries arise. On either side of the vertebral column, reaching from the heart to the pelvis, are two large glandular structures, the *corpora Wolffiana*, which consist of a series of convoluted tubes opening into a common excretory duct, running along their external borders, and connected below with the common cloaca of the genito-urinary and digestive tracts. They seem to act as secreting glands, and fulfil the functions of the kidneys before these are formed. Towards the end of the second month they atrophy and disappear, and the only trace of them in the fœtus at term is to be found in the parovarium lying between the folds of the broad ligaments. At this stage of development there are met with in the human embryo, as in that of all mammals, four transparent fissures opening into the pharynx, which are analogous to the permanent branchiæ of fishes. Their vascular supply is also similar, as the aorta at this time gives off four branches on each side, each of which forms a branchial arch, and these afterwards unite to form the descending aorta. By the end of the sixth week these, as well as the transverse fissures to which they are distributed, disappear. By the end of the second month the kidneys and supra-renal capsules are forming, and the single ventricle is divided into two by the growth of the inter-ventricular septum. The umbilical cord is quite straight, and is inserted into the lower part of the abdomen. Centres of ossification are showing themselves in the inferior maxillary bones and the clavicle.

3d Month.—The embryo weighs from 70 to 300 grains, and measures from 2½ to 3½ inches in length. The forearm is well formed, and the first traces of the fingers can be made out. The hand is large in proportion to the rest of the body, and the eyes are prominent. The umbilical vesicle and allantois have disappeared, the greater portion of the chorion villi have atrophied, and the placenta is distinctly formed.

4th Month.—The weight is from 4 to 6 oz., and the length about 6 inches. The convolutions of the brain are beginning to develop. The muscles are sufficiently formed to produce distinct movements of the limbs. Ossification is extending, and can be traced in the occipital and frontal bones, and in the mastoid processes. The sexual organs are differentiated.

5th Month.—Weight about 10 oz.; length, 9 or 10 inches. Hair is observed covering the head, which forms about one-third in length of the whole fœtus. The nails are beginning to form, and ossification has commenced in the ischium.

6th Month.—Weight about 1 lb. Length, 11 to 12½ inches. The hair is darker. The eyelids are closed, and the membrana pupillaris exists; eyelashes have now been formed. Some fat is deposited under the skin. The pubic bones have begun to ossify.

7th Month.—Weight, from 3 to 4 lbs. Length, 13 to 15 inches. The skin is covered with unctuous, sebaceous matter, and there is a more considerable deposit of subcutaneous fat. The eyelids are open. The testicles have descended into the scrotum.

8th Month.—Weight, from 4 to 5 lbs. Length, 16 to 18 inches, and the fœtus seems now to grow in thickness rather than in length. The membrana pupillaris has completely disappeared.

At the completion of pregnancy the fœtus weighs on an average 6½ lbs., and measures about 20 inches in length. These averages are, however, liable to great variation. Remarkable histories are given by many writers of fœtuses of extraordinary weight, which have been probably greatly exaggerated. Out of 3000 children delivered under the care of Cazeaux at various charities, one only weighed 10 lbs. There are, however, several carefully recorded instances of weights far exceeding this, but they are undoubtedly much more uncommon than is generally supposed. Dr. Ramsbotham mentions a fœtus weighing 16½ lbs., and Cazeaux tells of one that he delivered by turning which weighed 18 lbs. and measured 2 feet 1½ inches. Such overgrown children are almost invariably still-born. On the other hand, mature children have been born and survived which have not weighed more than 5 lbs.

The average size of male children at birth, as in after-life, is somewhat greater than that of female. Thus, Simpson[1] found that out of 100 cases the male children averaged 10 oz. more in weight than the female, and ½ an inch more in length. A new-born child at term is generally covered to a greater or less extent with a greasy, unctuous material, the *vernix caseosa*, which is formed of epithelial scales and the secretion of the sebaceous glands, and which is said to be of use in labor, by lubricating the surface of the child. The head is generally covered with long dark hair, which frequently falls off or changes in color shortly after birth. Dr. Wiltshire[2] has drawn attention to an old observation, that the eyes of all new-born children are of a peculiar dark steel-gray color, and that they do not acquire their permanent tint until some time after birth. The umbilical cord is generally inserted below the centre of the body.

The most important part of the fœtus from an obstetrical point of view is the head, which requires a separate study, as it is the usual presenting part, and the facility of the labor depends on its accurate adaptation to the maternal passages.

Anatomy of the Fœtal Head.—The chief anatomical peculiarity of interest, in the head of the fœtus at term, is that the bones of the skull, especially of its vertex—which, in the vast majority of cases, has to pass first through the pelvis—are not firmly ossified as in adult life, but are joined loosely together by membrane or cartilage. The result of this is, that the skull is capable of being moulded and altered in form to a very considerable extent by the pressure to which it is subjected, and thus its passage through the pelvis is very greatly facilitated. This, however, is chiefly the case with the cranium proper, the bones of the face and of the base of the skull being more firmly united. By this means the delicate structures at the base of the brain are protected from pressure, while the change of form which the skull undergoes during labor implicates a portion of the skull where pressure on the cranial contents is least likely to be injurious.

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[1] Selected Obst. Works, p. 327.

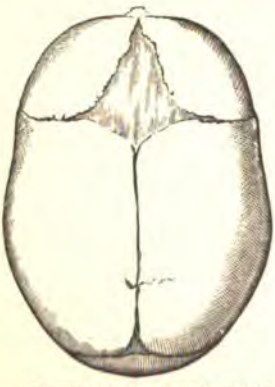
[2] Lancet, February 11, 1871.

The divisions between the bones of the cranium are further of obstetric importance in enabling us to detect the precise position of the head during labor, and an accurate knowledge of them is therefore essential to the obstetrician.

We talk of them as *sutures* and *fontanelles*, the former being the lines of junction between the separate bones which overlap each other to a greater or less extent during labor; the latter, membranous interspaces where the sutures join each other.

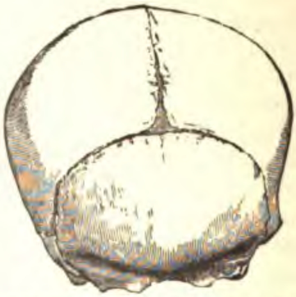
The principal sutures are: 1st, the *sagittal*, which separates the two parietal bones, and extends longitudinally backwards along the *vertex* of the head; 2d, the *frontal*, which is a continuation of the sagittal, dividing the two halves of the frontal bone, at this time separate from each other; 3d, the *coronal*, which separates the frontal from the parietal bones, extending from the squamous portion of the temporal bone across the head to a corresponding point on the opposite side; and 4th, the *lambdoidal*, receiving its name from its resemblance to the Greek letter Λ, which separates the occipital bone from the parietal bones on either side. The fontanelles (Fig. 57) are the membranous interspaces where these sutures join—the *anterior* and larger of the two being lozenge-shaped, and formed by the junction of the frontal, sagittal, and two halves of the coronal sutures. It will be well to note that there are therefore four lines of sutures running into it, and four angles,

FIG. 57.



ANTERIOR AND POSTERIOR FONTANELLES.

FIG. 58.

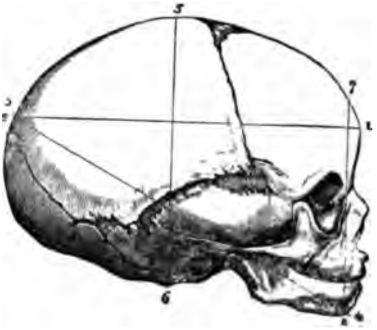


BI-PARIETAL DIAMETER, SAGITTAL AND LAMBDOIDAL SUTURES, WITH POSTERIOR FONTANELLE.

of which the anterior, formed by the frontal suture, is most elongated and well marked. The *posterior* fontanelle is formed by the junction of the sagittal suture with the two legs of the lambdoidal. It is therefore triangular in shape, with three lines of suture entering it in three angles, and is much smaller than the anterior fontanelle, forming merely a depression into which the top of the finger can be placed, while the latter is a hollow as big as a shilling, or even larger. As it is the posterior fontanelle which is generally lowest, and the one most commonly felt during labor, it is important for the student to familiarize himself with it, and he should lose no opportunity of studying the sensations imparted to the finger by the sutures and fontanelles in the head of the child after birth.

The Diameters of the Fœtal Skull.—For the purpose of understanding the mechanism of labor, we must study the measurements of the fœtal head in relation to the cavity through which it has to pass. These are taken from corresponding points opposite to each other, and are known as the diameters of the skull (Fig. 59). Those of most importance are: 1st. The *occipito-mental*, from the occipital protuberance to the point of the chin, 5.25″ to 5.50″. 2d. The *occipito-frontal*, from the occiput to the centre of the forehead, 4.50″ to 5″. 3d. The *sub-occipito-bregmatic*, from a point midway between the occipital protuberance and the margin of the foramen magnum to the centre of the anterior fontanelle, 3.25″. 4th. The *cervico-bregmatic*, from the anterior margin of the foramen magnum to the centre of the anterior fontanelle, 3.75″. 5th. *Transverse* or *bi-parietal*, between the parietal protuberances, 3.75″ to 4″. 6th. *Bi-temporal*, between the ears, 3.50″. 7th. *Fronto-mental*, from the apex of the forehead to the chin, 3.25″.

FIG. 59.



1 & 2. Occipito-frontal diameter.
3 & 4. Occipito-mental.
5 & 6 Cervico-bregmatic.
7 & 8. Fronto-mental.

The length of these respective diameters, as given by different writers, differs considerably—a fact to be explained by the measurements having been taken at different times; by some just after birth, when the head was altered in shape by the moulding it had undergone; by others when this had either been slight, or after the head had recovered its normal shape. The above measurements may be taken as the average of those of the normally-shaped head, and it is to be noted that the first two are most apt to be modified during labor. The amount of compression and moulding to which the head may be subjected, without proving fatal to the fœtus, is not certainly known, but it is doubtless very considerable. Some interesting examples of the extent to which the head may be altered in shape in difficult labors have been given by Dr. Barnes,[1] who has shown, by tracings of the shape of the head taken immediately after delivery, that in protracted labor the occipito-mental and occipito-frontal diameters may be increased more than an inch in length, while a lateral compression may diminish the bi-parietal diameter to the same measurement as the inter-auricular. The fœtal head is movable on the vertebral column to the extent of a quarter of a circle, and it seems probable that the laxity of the ligaments admits with impunity a greater circular movement than would be possible in the adult.

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[1] Obst. Trans., vol. vii.

Influence of Sex and Race.—On taking the average of a large number of measurements, it is found that the heads of male children are larger and more firmly ossified than those of females, the former averaging about half an inch more in circumference. Sir James Simpson attributed great importance to this fact, and believed that it was sufficient to account for the larger proportion of still births in male than in female children, as well as for the greater difficulty of labor and maternal mortality that are found to attend on male births. His well-known paper on this subject, which has given rise to much controversy, is full of the most elaborate details; and so great did he believe the fœtal influence to be, that he calculated that between the years 1834 and 1837 there were lost in Great Britain, as a consequence of the slightly larger size of the male than of the female head at birth, about 50,000 lives, including those of about 46,000 or 47,000 infants, and of between 3000 and 4000 mothers who died in childbed.[1] It is probable that race and other conditions, such as civilization and intellectual culture, have considerable influence on the size of the fœtal skull; but we are not in possession of sufficiently accurate data to justify any very positive opinions on these points.

Position of the Fœtus in Utero.—In the very large majority of cases the fœtus lies in utero with the head downwards, and so placed as to be adapted in the most convenient way to the cavity in which it is placed. The uterine cavity is most roomy at the fundus, and narrowest at the cervix, and the greatest bulk of the fœtus is at the breech, so that the largest part of the child usually lies in the part of the uterus best adapted to contain it. The various parts of the child's body are farther so placed, in regard to each other, as to take up the least possible amount of space. The body is bent so that the spine is curved with its convexity outwards, this curvature existing from the earliest period of development; the chin is flexed on the sternum; the forearms are flexed on the arms, and lie close together on the front of the chest; the legs are flexed on the thighs, and the thighs drawn up on the abdomen; the feet are drawn up towards the leg, so that the heel is lower than the toes; the umbilical cord is generally placed out of reach of injurious pressure, in the space between the arms and the thighs. Variations from this attitude, however, are not uncommon, and are not, as a rule, of much consequence. Although the cranial presentations are much the most common, averaging 96 out of every 100 cases, other presentations are by no means rare, the next most frequent being either that of the breech, in which the long diameter of the child lies in the long diameter of the uterine cavity, or some variety of transverse presentation, in which the long diameter of the fœtus lies obliquely across the uterus, and no longer corresponds to its longitudinal axis.

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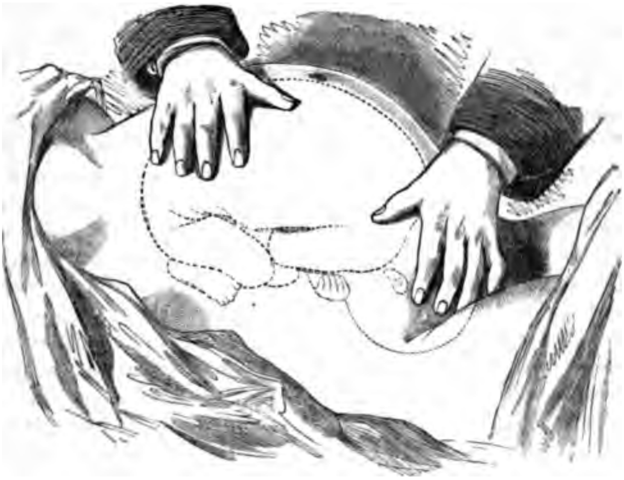
[1] Selected Obst. Works, p. 363.

It was long believed that the head presentation was only assumed towards the end of pregnancy, when it was supposed to be produced by a sudden movement on the part of the fœtus known as the *culbute*. It is now well known that, in the large majority of cases, the head is lowest during all the latter part of pregnancy, although changes in position are more common than is generally believed to be the case, and presentation of parts other than the head is much more frequent in premature labor than in delivery at term. In evidence of the last statement, Churchill says that in labor at the seventh month the head presents only 83 times out of 100 when the child is living, and that as many as 53 per cent. of the presentations are preternatural when the child is still-born. The frequency with which the fœtus changes its position before delivery has been made the subject of investigation by various German obstetricians, and the fact can be readily ascertained by examination. Valenta[1] found that out of nearly 1000 cases, carefully and frequently examined by him, in 57.6 per cent. the presentation underwent no change in the latter months of pregnancy, but in the remaining 42.4 per cent. a change could be readily detected. These alterations were found to be most frequent in multiparæ, and the tendency was for abnormal presentations to alter into normal ones. Thus, it was common for transverse presentations to alter longitudinally, and but rare for breech presentations to change into head. The ease with which these changes are effected no doubt depends, in a considerable degree, on the laxity of the uterine parietes, and on the greater quantity of amniotic fluid, by both of which the free mobility of the fœtus is favored.

FIG. 60.



MODE OF ASCERTAINING THE POSITION OF THE FŒTUS BY PALPATION.

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[1] Mon. f. Geburt., 1866.

The facility with which the position of the fœtus in utero can be ascertained by abdominal palpation has not been generally appreciated in obstetric works, and yet, by a little practice, it is easy to make it out. Much information of importance can be gained in this way, and it is quite possible, under favorable circumstances, to alter abnormal presentations before labor has begun. For the purpose of making this examination, the patient should lie at the edge of the bed, with her shoulders slightly raised, and the abdomen uncovered. The first observation to make is to see if the longitudinal axis of the uterine tumor corresponds with that of the mother's abdomen; if it does, the presentation must be either a head or a breech. By spreading the hands over the uterus (Fig. 60), a greater sense of resistance can be felt, in most cases, on one side than on the other, corresponding to the back of the child. By striking the tips of the fingers suddenly inwards at the fundus, the hard breech can generally be made out, or the head, still more easily, if the breech be downwards. When the uterine walls are unusually lax, it is often possible to feel the limbs of the child. These observations can be generally corroborated by auscultation, for in head presentations the fœtal heart can usually be heard below the umbilicus, and in breech cases above it. Transverse presentations can even more easily be made out by abdominal palpation. Here the long axis of the uterine tumor does not correspond with the long axis of the mother's abdomen, but lies obliquely across it. By palpation the rounded mass of the head can be easily felt in one of the mother's flanks, and the breech in the other, while the fœtal heart is heard pulsating nearer to the side at which the head is detected.

The reason why the head presents so frequently has been made the subject of much discussion. The oldest theory was, that the head lay over the os uteri as the result of gravitation, and the influence of gravity, although contested by many obstetricians, prominent among whom were Dubois and Simpson, has been insisted upon as the chief cause by others, Dr. Duncan being one of the most strenuous advocates of this view. The objections urged against the gravitation theory were drawn partly from the results of experiments, and partly from the frequency with which abnormal presentations occurred in premature labors, when the action of gravity could not be supposed to be suspended. The experiments made by Dubois went to show that, when a fœtus was suspended in water, gravitation caused the shoulders, and not the head, to fall lowest. He therefore advanced the hypothesis that the position of the fœtus was due to instinctive movements which it made to adapt itself to the most comfortable position in which it could lie. It need only be remarked that there is not the slightest evidence of the fœtus possessing any such power. Simpson proposed a theory which was much more plausible. He assumed that the fœtal position was due to reflex movements produced by physical irritations to which the cutaneous surface of the fœtus is subjected from changes of the mother's position, uterine contractions, and the like. The absence of these movements in the case of the death of the fœtus would readily explain the frequency of mal-presentation under such circumstances. The obvious objection to this theory, complete as it seems to be, is the absence of any proof that such constant extensive reflex movements really do occur in utero. Dr. Duncan has very conclusively disposed of the principal objections which have been raised against the influence of gravitation, and when an obvious explanation of so simple a kind exists, it seems useless to seek further for another. He has shown that Dubois' experiments did not accurately represent the state of the fœtus in utero, and that during the greater part of the day, when the woman is upright, or lying on her back, the fœtus lies obliquely to the horizon at an angle of about 30°. The child thus lies, in the former case, on an inclined plane, formed by the anterior uterine wall and by the abdominal parietes, in the latter by the posterior uterine wall and the vertebral column. Down the inclined plane so formed the force of gravity

FIG. 61.

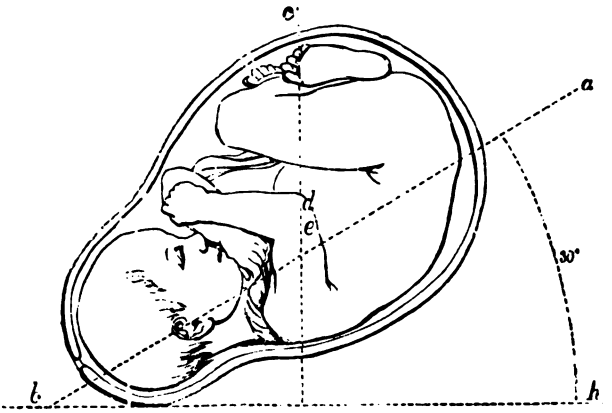
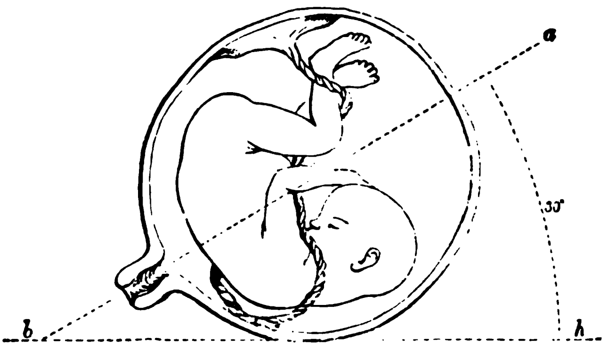


DIAGRAM ILLUSTRATING THE EFFECT OF GRAVITY ON THE FŒTUS. (After Duncan.)
a, *b*, is parallel to the axis of the pregnant uterus and pelvic brim. *c*, *d*, *e*, is a perpendicular line. *e*, the centre of gravity of the fœtus. *d*, the centre of flotation.

FIG. 62.



ILLUSTRATING THE GREATER MOBILITY OF THE FŒTUS AND THE LARGER RELATIVE AMOUNT OF LIQUOR AMNII IN EARLY PREGNANCY.
a, *b*. Axis of pregnant uterus. *b*, *h*. A horizontal line.

causes the fœtus to slide, and it is only when the woman lies on her side that the fœtus is placed horizontally, and is not subjected in the same degree to the action of gravity (Fig. 61). The frequency of malpresentations in premature labors is explained by Dr. Duncan partly by the fact that the death of the child (which so frequently precedes such cases) alters its centre of gravity, and partly by the greater mobility of the child and the greater relative amount of liquor amnii (Fig. 62). The influence of gravitation is probably greatly assisted by the contractions of the uterus which are going on during the greater part of pregnancy. The influence of these was pointed out by Dr. Tyler Smith, who distinctly showed that the contractions of the uterus preceding delivery exerted a moulding or adapting influence on the fœtus, and prevented undue alterations of its position. Dr. Hicks proved[1] that these uterine contractions are of constant occurrence from the earliest period of pregnancy, and there can be little doubt that they must have an important influence on the body contained within the uterus.

The *functions of the fœtus* are in the main the same, with differences depending on the situation in which it is placed, as those of the separate being. It breathes, it is nourished, it forms secretions, and its nervous system acts. The mode in which some of these functions are carried on in intra-uterine life requires separate consideration.

1. *Nutrition.*—During the early period of pregnancy, and before the formation of the umbilical vesicle and the allantois, it is certain that nutritive material must be supplied to the ovum by endosmosis through its external envelope. The precise source, however, from which this is obtained is not positively known. By some it is believed to be derived from the granulations of the discus proligerus which surround the ovum as it escapes from the Graafian follicle, and subsequently from the layer of albuminous matter which surrounds the ovum before it reaches the uterus; while others think it probable that it may come from a special liquid secreted by the interior of the Fallopian tube as the ovum passes along it. As soon as the ovum has reached the uterus, there is every reason to believe that the umbilical vesicle is the chief source of nourishment to the embryo, through the channel of the omphalo-mesenteric vessels which convey matters absorbed from the interior of the vesicle to the intestinal canal of the fœtus. At this time the exterior of the ovum is covered by the numerous fine villosities of the primitive chorion, which are imbedded in the mucous membrane of the uterus, and it is thought that they may absorb materials from the maternal system, which may either directly be absorbed by the embryo, or which may serve the purpose of replacing the nutritive matter which has been removed from the umbilical vesicle by the omphalo-mesenteric vessels. This point it is, of course, impossible to decide. Joulin, however, thinks that these villi probably have no direct influence on the nourishment of the fœtus, which is at this time solely effected by the umbilical vesicle, but that they absorb fluid from the maternal system, which passes through the amnion and forms the liquor amnii. As soon as the allantois is developed, vascular communication between the fœtus and the maternal structures is established, and the temporary function of the

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[1] Obst. Trans., vol. xiii. p. 216.

umbilical vesicle is over; that structure, therefore, rapidly atrophies and disappears, and the nutrition of the fœtus is now solely carried on by means of the chorion villi, lined as they now are by the vascular endochorion, and chiefly by those which go to form the substance of the placenta.

This statement is opposed to the views of many physiologists, who believe that a certain amount of nutritive material is conveyed to the fœtus through the channel of the liquor amnii, itself derived from the maternal system, which is supposed either to be absorbed through the cutaneous surface of the fœtus, or carried to the intestinal canal by deglutition. The reasons for assigning to the liquor amnii a nutritive function are, however, so slight that it is difficult to believe that it has any appreciable action in this way. They are based on some questionable observations, such as those of Weydlich, who kept a calf alive for fifteen days by feeding it solely on liquor amnii, and the experiments of Burdach, who found the cutaneous lymphatics engorged in a fœtus removed from the amniotic cavity, while those of the intestine were empty. The deglutition of the liquor amnii for the purposes of nutrition has been assumed from its occasional detection in the stomach of the fœtus, the presence of which may, however, be readily explained by spasmodic efforts at respiration, which the fœtus undoubtedly often makes before birth, especially when the placental circulation is in any way interfered with, and during which a certain quantity of fluid would necessarily be swallowed. The quantity of nutritive material, moreover, in the liquor amnii is so small—not more than six to nine parts of albumen in 1000—that it is impossible to conceive how it could have any appreciable influence in nutrition, even if its absorption, either by the skin or stomach, was susceptible of proof.

That the nutrition of the fœtus is effected through the placenta is susceptible of proof, by the common observation that whenever the placental circulation is arrested, as by disease of its structure, the fœtus atrophies and dies. The precise mode, however, in which nutritive materials are absorbed from the maternal blood is still a matter of doubt, and must remain so until the mooted points as to the minute anatomy of the placenta are settled. The various theories entertained on this subject by the upholders of the Hunterian doctrine of placental anatomy, and by those who deny the existence of a sinus system, have been already referred to in the chapter on the Anatomy of the Placenta, to which the reader is referred (pp. 100, 101).

Respiration.—One of the chief functions of the placenta, besides that of nutrition, is the supply of oxygenated blood to the fœtus. That this is essential to the vitality of the fœtus, and that the placenta is the site of oxygenation, are proved by the facts that whenever the placenta is separated, or the access of fœtal blood to it arrested by compression of the cord, instinctive attempts at inspiration are made, and if aerial respiration cannot be performed, the fœtus is expelled asphyxiated. Like the other functions of the fœtus during intra-uterine life, that of respiration has been made the subject of numerous more or less ingenious hypotheses. Thus, many have believed that the fœtus absorbed from the liquor amnii gaseous material, which served the purpose of oxygenating its blood, St. Hilaire thinking that this was effected by minute openings in its skin, Beclard and others through the bronchi, to which they believed the liquor amnii gained access. Independently of the entire want of evidence of the absorption of gaseous materials by these channels, the theory is disproved by the fact that the liquor amnii contains no air which is capable of respiration. Serres attributed a similar function to some of the chorion villi, which he believed penetrated the utricular glands of the decidua reflexa, and absorbed gas from the hydroperione, or fluid situated between it and the decidua vera, and in this manner he thought the fœtal blood was oxygenated until the fifth month of intra-uterine life, when the placenta was fully formed. This hypothesis, however, rests on no accurate foundation, for it is certain that the chorion villi do not penetrate the utricular glands in the manner assumed; or even if they did, the mode in which the oxygen thus absorbed by the chorion villi reaches the fœtus, which is separated from them by the amnion and its contents, would still remain unexplained.

The mode in which the oxygenation of the fœtal blood is effected before the formation of the placenta remains, therefore, as yet unknown. After the development of that organ, however, it is less difficult to understand, for the fœtal blood is everywhere brought into such close contact with the maternal, in the numerous minute ramifications of the umbilical vessels, that the interchange of gases can readily be effected. The activity of respiration is doubtless much less than in extra-uterine life, for the waste of tissue in the fœtus is necessarily comparatively small, from the fact of its being suspended in a fluid medium of its own temperature, and from the absence of the processes of digestion and of respiratory movements. The quantity of carbonic acid formed would, therefore, be much less than after birth, and there would be a correspondingly small call for oxygenation of venous blood.

Circulation.—The functions of the lungs being in abeyance, it is necessary that all the fœtal blood should be carried to the placenta to receive oxygen and nutritive materials. To understand the mode in which this is effected, it is necessary to bear in mind certain peculiarities in the circulatory system which disappear after birth.

1. *Anatomical Peculiarities.*—The two sides of the fœtal heart are not separate, as in the adult. The right ventricle in the adult sends all the venous blood to the lungs, through the pulmonary arteries, to be aerated by contact with the atmosphere. In the fœtus, however, only sufficient blood is passed through the pulmonary arteries to ensure their being pervious and ready to carry blood to the lungs immediately after birth.

An aperture of communication exists between the two auricles, the *foramen ovale,* which is arranged so as to permit the blood reaching the right auricle to pass freely into the left, but not *vice versâ.* By this means a large portion of the blood reaching the heart through the venæ cavæ, instead of passing, as in the adult, into the right ventricle, is directed into the left auricle.

2. Even with this arrangement, however, a larger portion of blood would pass into the pulmonary arteries than is required for transmission

to the lungs, and a further provision is made to prevent its going to them, by means of a fœtal vessel, the *ductus arteriosus* (Fig. 63), which arises from the points of bifurcation of the pulmonary arteries and opens into the arch of the aorta. In consequence of this arrangement only a very small portion of the blood reaches the lungs at all.

FIG. 63.

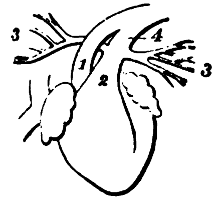

DIAGRAM OF FŒTAL HEART.

1. Aorta.
2. Pulmonary artery.
3, 3. Pulmonary branches.
4. Ductus arteriosus.

3. The fœtal hypogastric arteries are continued into two large arterial trunks, which, passing into the cord, form the *umbilical arteries,* and carry the impure fœtal blood to the placenta.

4. The purified blood is collected into the single *umbilical vein,* through which it is carried to the under surface of the liver, from which point it is conducted, by means of another special fœtal vessel, the *ductus venosus,* into the ascending vena cava, and the right auricle.

Course of the Fœtal Circulation.—In order to understand the course of the fœtal blood, it may be most conveniently traced from the point where it reaches the under surface of the liver through the umbilical vein. Part of it is distributed to the liver itself, but the greater quantity is carried directly into the vena cava through the ductus venosus. The vena cava also receives the blood from the fœtal veins of the lower extremities, and that portion of the blood of the umbilical vein which has passed through the liver. This mixed blood is carried up to the right auricle, from which by far the greater part of it is immediately directed into the left auricle, through the foramen ovale. From thence it passes into the left ventricle, which sends the greater part of it into the head and upper extremities through the aorta, a comparatively small quantity being transmitted to the inferior extremities. The blood which is thus sent to the upper part of the body is collected into the vena cava superior, by which it is thrown into the right auricle. Here the mass of it is probably directed into the right ventricle, which expels it into the pulmonary arteries, and from thence through the ductus arteriosus into the descending aorta. By this arrangement it will be seen that the descending aorta conveys to the lower part of the body the comparatively impure blood which has already circulated through the head, neck, and upper extremities. From the descending aorta a small quantity of blood is conveyed to the lower extremities, the greater part of it being carried for purification to the placenta through the umbilical arteries.

Establishment of Independent Circulation.—As soon as the child is born it generally cries loudly, and inflates its lungs, and, in consequence, the pulmonary arteries are dilated, and the greater portion of the blood of the right ventricle is at once sent to the lungs, from whence, after being arterialized, it is returned to the left auricle, through the pulmonary veins. The left auricle, therefore, receives more blood than before, the right less, and, the placental circulation being arrested, no more passes through the umbilical vein. In consequence of this, the pressure of the blood in the two auricles is equalized, the mass of the blood in the right auricle no longer passes into the left (the valve of the foramen ovale being closed by the equal pressure on both sides), but directly into the right ventricle, and from thence into the pulmonary arteries, the ductus arteriosus collapses and soon becomes impervious. The mass of blood in the descending aorta no longer finds its way into the hypogastric arteries, but passes into the lower extremities, and the adult circulation is established.

The changes which take place in the temporary vascular arrangements of the fœtus, prior to their complete disappearance, are of some practical interest. The ductus arteriosus, as has been said, collapses, chiefly because the mass of blood is drawn to the lungs, and partly perhaps by its own inherent contractility. Its walls are found to be thickened, and its canal closes, first in the centre, and subsequently at its extremities, its aortic end remaining longer pervious on account of the greater pressure of blood from the left side of the heart (Fig. 64). Practical closure occurs within a few days after birth, although Flourens states that it is not completely obliterated until eighteen months or two years have elapsed.[1] According to Schroeder, its walls unite without the formation of any thrombus. The foramen ovale is soon closed by its valve, which contracts adhesion with the edges of the aperture, so as effectually to occlude it. Sometimes, however, a small canal of communication between the two auricles may remain pervious for many months, or even a year and more, without, however, any admixture of blood occurring. A permanently patulous condition of this aperture, however, sometimes exists, giving rise to the disease known as cyanosis.

FIG. 64.

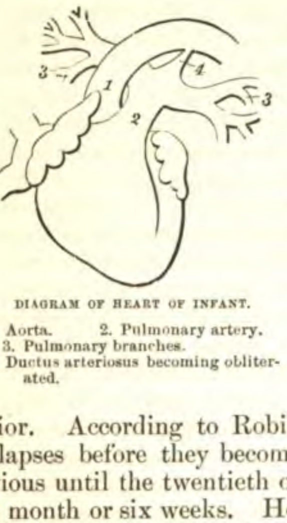

DIAGRAM OF HEART OF INFANT.

1. Aorta. 2. Pulmonary artery.
3, 3. Pulmonary branches.
4. Ductus arteriosus becoming obliterated.

The umbilical arteries and veins, and the ductus venosus, soon also become impermeable, in consequence of concentric hypertrophy of their tissues and collapse of their walls. The closure of the former is aided by the formation of coagula in their interior. According to Robin, a longer time than is usually supposed elapses before they become completely closed, the vein remaining pervious until the twentieth or thirtieth day after delivery, the arteries for a month or six weeks. He has also described[2] a remarkable contraction of the umbilical vessels within their sheaths, at the point where they leave the abdominal walls, which takes place within three or four days after birth, and seems to prevent hemorrhage taking place when the cord is detached.

Function of the Liver.—The liver, from its proportionately large size, apparently plays an important part in the fœtal economy. It is not until about the fifth month of utero-gestation that it assumes its characteristic structure, and forms bile, previous to that time its texture being soft and undeveloped. According to Claude Bernard, after this period one of its most important offices is the formation of sugar, which is found in much larger amount in the fœtus than after birth. Sugar is, however, found in the fœtal structures long before the development of the liver, especially in the mucous and cutaneous tissues, and it seems probable that these, as well as the placenta itself, then fulfil the glycogenic function, afterwards chiefly performed by the liver. The bile is secreted after the fifth month of pregnancy, and passes into the intestinal canal, and is subsequently collected in the gall-bladder. By some physiologists it has been supposed that the liver, during intra-uterine life, was the chief seat of depuration of the carbonic acid contained in the venous blood of the fœtus. It is, however, more generally believed that this is accomplished solely in the placenta. The bile, mixed with the mucous secretion of the intestinal tract, forms the *meconium* which is contained in the intestines of the fœtus, and which collects in them during the whole period of intra-uterine life. It is a thick, tenacious, greenish substance, which is voided soon after birth in considerable quantity.

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[1] Acad. des Sciences, 1854.

[2] Ibid., 1860.

Urine is certainly formed during intra-uterine life, as is proved by the fact familiar to all accoucheurs, that the bladder is constantly emptied instantly after birth. It has generally been supposed that the fœtus voided its urine into the cavity of the amnion, and the existence of traces of urea in the liquor amnii, as well as some cases of imperforate urethra, in which the bladder was found to be enormously distended, have been supposed to corroborate this assumption. The question has been very fully studied by Joulin, who has collected together a large number of instances in which there was imperforate urethra without any undue distension of the bladder. He holds also that the amount of urea found in the liquor amnii is far too minute to justify the conclusion that the urine of the fœtus was habitually poured into it, although a small quantity may, he thinks, escape into it from time to time; and he therefore believes that the urine of the fœtus is only secreted regularly and abundantly after birth, and that during intra-uterine life its retention is not likely to give rise to any functional disturbance.[1]

Function of the Nervous System.—There is no doubt that the nervous system acts to a considerable extent during intra-uterine life, and some authors have even supposed that the fœtus was endowed with the power of making instinctive or voluntary movements for the purpose of adapting itself to the form of the uterine cavity. There can be no question, however, that the movements the fœtus performs are purely reflex and automatic. That it responds to stimuli applied to the cutaneous nerves is proved by the experiments of Tyler Smith, who laid bare the amnion in pregnant rabbits, and found that the fœtus moved its limbs when these were irritated through it. Pressure on the mother's abdomen, cold applications, and similar stimuli, will also produce energetic fœtal movements. The gray matter of the brain in the new-born child is, however, quite rudimentary in its structure, and there is no evidence of intelligent action of the nervous system until some time after birth, and *a fortiori* during pregnancy.

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[1] Op. cit., p. 308.

CHAPTER III.

PREGNANCY.

As soon as conception has taken place, a series of remarkable changes commence in the uterus, which progress until the termination of pregnancy, and are well worthy of careful study. They produce those marvellous modifications which effect the transformation of the small undeveloped uterus of the non-pregnant state into the large and fully-developed uterus of pregnancy, and have no parallel in the whole animal economy.

A knowledge of them is essential for the proper comprehension of the phenomena of labor, and for the diagnosis of pregnancy which the practitioner is so frequently called upon to make. Excluding the varieties of abnormal pregnancy, which will be noticed in another place, we shall here limit ourselves to a consideration of the modifications of the maternal organism which result from simple and natural gestation.

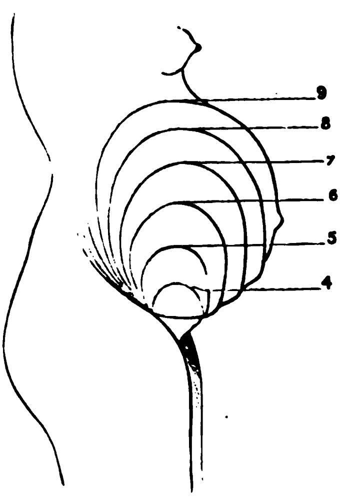
Changes in the Form and Dimensions.—The unimpregnated uterus measures 2½ inches in length, and weighs about an ounce, while at the full term of pregnancy it is so immensely hypertrophied as to weigh 24 oz. and measure 12 inches. This hypertrophy commences as soon as the ovum reaches the uterus, and continues uninterruptedly until delivery. In the early months the uterus is contained entirely in the cavity of the pelvis, and the increase of size is only apparent on vaginal examination, and that with difficulty. At this time the growth of the organ is chiefly in the lateral direction, so that the whole body of the uterus assumes more of a spherical shape than in the non-pregnant state, and this continues during the first three months, when the uterus is contained within the true pelvis. If an opportunity of examining the gravid uterus post mortem should occur at this time, it will be found to have the form of a sphere flattened somewhat posteriorly, and bulging anteriorly.

After the ascent of the organ into the abdomen, it develops more in the vertical direction, so that at term it has the form of an ovoid, with its large extremity above and its narrow end placed at the cervix uteri, and with its longitudinal axis corresponding to the long diameter of the mother's abdomen, provided the presentation be either of the head or breech. The anterior surface is now even more distinctly projecting than before—a fact which is explained by the relation of the posterior surface to the rigid spinal column behind, while the anterior is in relation to the lax abdominal parietes, which yield readily to pressure, and so allow of the more marked prominence of the anterior uterine wall.

Changes in Situation.—Before the gravid uterus has risen out of the pelvis no appreciable increase in the size of the abdomen is perceptible. On the contrary, it is an old observation that at this early stage of pregnancy the abdomen is flatter than usual, on account of the partial descent of the uterus in the pelvic cavity as a result of its increased weight. As the growth of the organ advances it soon becomes too large to be contained any longer within the pelvis, and about the middle of the third or the beginning of the fourth month the fundus rises above the pelvic brim—not suddenly, as is often erroneously thought, but slowly and gradually—when it may be felt as a smooth rounded swelling.

It is about this time that the movements of the fœtus first become appreciable to the mother, when "quickening" is said to have taken place. Towards the end of the fourth month the uterus reaches to about three fingers' breadth above the symphysis pubis. About the fifth month it fills the hypogastric region, to which it imparts a marked projection, and the alteration in the figure is now distinctly perceptible to visual examination. About the sixth month it is on a level with, or a little above, the umbilicus. About the seventh month it is about two inches above the umbilicus, which is now projecting and prominent, instead of depressed, as in the non-pregnant state. During the eighth and ninth months it continues to increase until it fills the entire abdominal cavity, the summit of the fundus being immediately below the ensiform cartilage (Fig. 65). A knowledge of the size of the uterine tumor at various periods of pregnancy, as thus indicated, is of considerable practical importance, as forming the only guide by which we can estimate the probable period of delivery in certain cases in which the usual data for calculation are absent, as, for example, when the patient has conceived during lactation. For about a week or more before labor the uterus will generally be found to have sunk somewhat into the pelvic cavity, in consequence of the relaxation of the soft parts which precedes delivery, and the patient will now feel herself smaller and lighter than before. This change is familiar to all childbearing women, to whom it is known as "the lightening before labor."

FIG. 65.



SIZE OF UTERUS AT VARIOUS PERIODS OF PREGNANCY.

The Direction of the Uterus.—While the uterus remains in the pelvis its longitudinal axis varies in direction, much in the same way as that of the non-pregnant uterus, sometimes being more or less vertical, at others in a state of anteversion or partial retroversion. These variations are probably dependent on the distension or emptiness of the bladder, which must necessarily affect the movable organ poised behind it. After the uterus has risen into the abdomen its tendency is to project forwards in the direction of the abdominal wall, which forms its chief support in front, so that in the erect position the long axis of the uterine tumor lies in the direction of the axis of the pelvic brim, forming an angle of about 30° with the horizon. In the semi-recumbent position, on the other hand, as Duncan[1] has pointed out, its direction becomes much more nearly vertical. In women who have borne many children, the abdominal parietes no longer afford an efficient support, and the uterus is displaced anteriorly, the fundus in extreme cases even hanging downwards.

Lateral Obliquity.—In addition to this anterior obliquity, the uterine tumor is very generally also displaced laterally, on account of the projection of the spinal column, and sometimes to a very marked degree, so that it is felt entirely in one flank, instead of in the centre of the abdomen. In the large proportion of cases this lateral deviation is to the right side, and many hypotheses have been brought forward to explain this fact, none of them being satisfactory. Thus, it has been supposed to depend on the greater frequency with which women lie on their right sides during sleep, on the greater use of the right leg during walking, on the supposed comparative shortness of the right round ligament, which drags the tumor to that side, or on the frequent distension of the rectum on the left side, which prevents the uterus being displaced in that direction. Of these the last is the cause which seems most constantly in operation, and most likely to produce the effect.

The cervix must obviously adapt itself to the situation of the uterus. We find, therefore, that in the early months, when the uterus lies low in the pelvis, it is more readily within reach. After the ascent of the uterus, it is drawn up along with it, and frequently so much so as to be reached with difficulty. When the uterus is much anteverted, as is so often the case, the cervix is displaced backwards, so that it cannot be felt at all by the examining finger.

Towards the end of pregnancy the whole of the anterior surface of the uterus is in contact with the abdominal wall, its lower portion resting on the posterior surface of the symphysis pubis. The posterior surface rests on the spinal column, while the small intestines are pushed to either side, the large intestines surrounding the uterus like an arch.

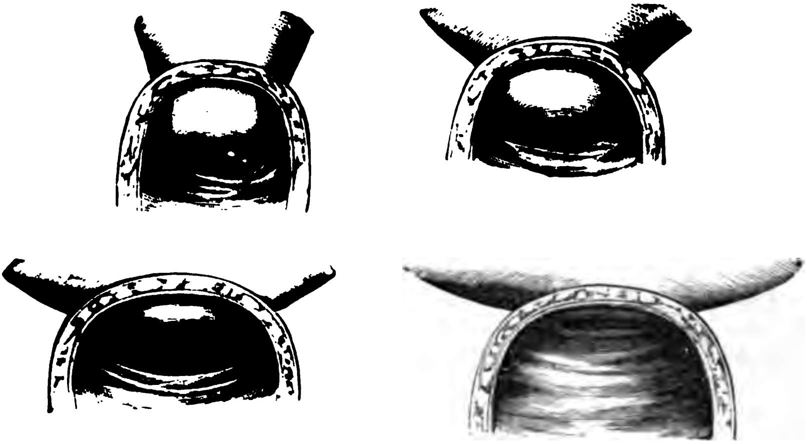
The great distension of the uterus during pregnancy was formerly supposed to be mainly due to the mechanical pressure of the enlarging ovum within it. If this were so, then the uterine walls would be necessarily much thinner than in the non-pregnant state. This is well known not to be the case, and the immense increase in the size of the uterine cavity is to be explained by the hypertrophy of its walls. At the full period of pregnancy the thickness of the uterine parietes is generally about the same as that of the non-pregnant uterus, rather more at the placental site, and less in the neighborhood of the cervix. Their thickness, however, varies in different cases, and in some women they are so thin as to admit of the fœtal limbs being very readily made out by palpation. Their density is, however, always much diminished, and,

[1] Researches in Obstetrics, p. 10.

instead of being hard and inelastic, they become soft and yielding to pressure. This change coincides with the commencement of pregnancy, of which it forms one of the earliest diagnostic marks. At a more advanced period it is of value as admitting of a certain amount of yielding of the uterine walls to the movements of the fœtus, thus lessening the chance of injury to the maternal structures.

Changes in the Cervix during Pregnancy.—Very erroneous views have long been taught, in most of our standard works on midwifery, as to the changes which occur in the cervix uteri during pregnancy. It is generally stated that, as pregnancy advances, the length of the cervical cavity is greatly diminished, in consequence of its being gradually drawn up so as to form part of the general cavity of the uterus, so that in the latter months it no longer exists. In almost all midwifery works accurate diagrams are given of the progressive shortening of the cervix (Figs. 66 to 69). It is generally described as having lost one-half of its length at the sixth month, two-thirds at the seventh, and to be entirely obliterated in the eighth and ninth. The correctness of these views was first called in question in recent times by Stoltz, in 1826, although Dr. Duncan,[1] in an elaborate historical paper on the subject, has shown that he was anticipated by Weitbrecht in 1750, and, to a less degree, by Roederer and other writers. His opinion is now pretty generally admitted to be correct, and is upheld by Cazeaux, Arthur Farre, Duncan, and most modern obstetricians. Various post-mortem examinations in advanced pregnancy have shown that the cavity of the cervix remains in reality of its normal length of one inch, and, indeed, it can often be measured during life by the examining finger, on account of its patulous state (Fig. 70). During the fortnight immediately preceding delivery, however, a real shortening or oblitera-

FIGS. 66, 67, 68, 69.



SUPPOSED SHORTENING OF THE CERVIX AT THE THIRD, SIXTH, EIGHTH, AND NINTH MONTHS OF PREGNANCY, AS FIGURED IN OBSTETRIC WORKS.

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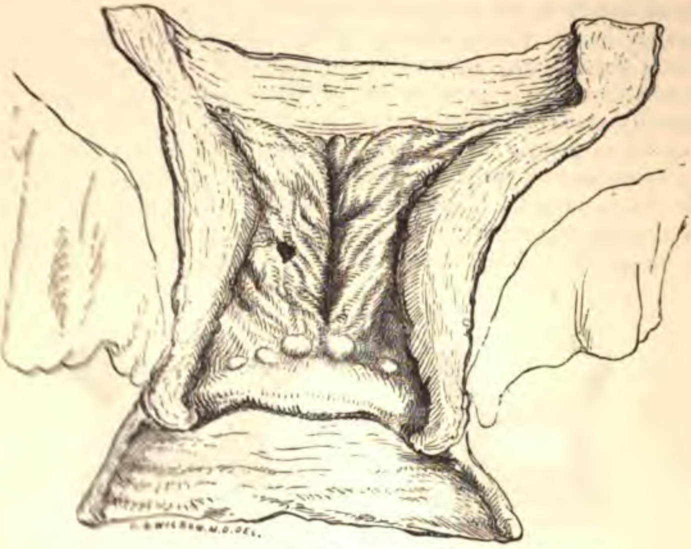
[1] Researches in Obstetrics.

tion of the cervical cavity takes place; but this, as Duncan has pointed out, seems to be due to the incipient uterine contractions which prepare the cervix for labor.

FIG. 70.



CERVIX FROM A WOMAN DYING IN THE EIGHTH MONTH OF PREGNANCY.

Apparent Shortening.—There is, no doubt, an apparent shortening of the cervix always to be detected during pregnancy; but this is a fallacious and deceptive feeling, due to the increased softness of the tissue of the cervix, which is exceedingly characteristic of pregnancy, and which to an experienced finger affords one of its best diagnostic marks.

Softening.—In the non-pregnant state the tissue of the cervix is hard, firm, and inelastic. When conception occurs, softening begins, commencing at the external os, and proceeding gradually and slowly upwards until it involves the whole tissue of the cervix. By the end of the fourth month both lips of the os are thin, softened, and velvety to the touch, giving an impression likened by Cazeaux to pressing on a table through a thick soft cover. By the sixth month at least one-half of the cervix is thus altered, and by the eighth the whole of it, and so much so that at this time those unaccustomed to vaginal examinations experience some difficulty in distinguishing the cervix from the vaginal walls. It is this softening, then, which gives rise to the apparent shortening of the cervix so generally described, and it is an invariable concomitant of pregnancy, except in some rare cases in which there has been antecedent morbid induration and hypertrophic elongation of the cervix. If, therefore, on examining a woman supposed to be advanced in pregnancy, we find the cervix to be hard and projecting into the vaginal canal, we may safely conclude that pregnancy does not exist. The existence of softening, however, it must be remembered, will not of itself justify an opposite conclusion, as it may be produced, to a very considerable extent, by various pathological conditions of the uterus.

At the same time that the tissue of the cervix is softened its cavity is widened, and the external os becomes patulous. This change varies considerably in primiparæ and multiparæ. In the former the external os often remains closed until the end of pregnancy; but even in them it generally becomes more or less patulous after the seventh month, and admits the tip of the examining finger. In women who have borne children this change is much more marked. The external os is in them generally fissured and irregular, from slight lacerations of its tissue in former labors. It is also sufficiently open to admit the tip of the finger, so that in the latter months of pregnancy it is often quite possible to touch the membranes, and through them to feel the presenting part of the child.

Changes in the Texture of the Uterine Tissues.—The remarkable increase in size of the uterus during pregnancy is, as we have seen, chiefly to be explained by the growth and hypertrophy of its structures, all of which are modified during gestation. The peritoneal covering is considerably increased by the growth of its component parts, so as still to form a complete covering to the uterus when at its largest size. William Hunter supposed that its extension was effected rather by the unfolding of the layers of the broad ligament than by growth of peritoneal tissue. That the layers of the broad ligament do unfold during gestation, especially in the early months, is probable; but this is not sufficient to account for the complete investment of the uterus, and it is certain that the peritoneum grows *pari passu* with the enlargement of the uterus. In addition there is a new formation of fibrous tissue between it and the muscular coat, which seems to afford strength, and diminish the risk of laceration during labor.

The hypertrophy of the muscular tissue of the uterus is, however, the most remarkable of the changes produced by pregnancy. Not only do the previously-existing rudimentary fibre-cells become enormously increased in size, so as to measure, according to Kölliker, from seven to eleven times their former length and from two to seven times their former breadth, but new unstriped fibres are largely developed, especially in the internal muscular layer. These new cells are chiefly found in the first months of pregnancy, and their growth seems to be completed by the sixth month. The connective tissue between them is also largely increased in amount. The weight of the muscular fibres of the gravid uterus is, therefore, much increased, and it has been estimated by Hersh that they weigh at times from 1 to 1.5 lbs., that is, about sixteen times more than in the unimpregnated state. This great increase of the muscular tissue admits of its dissection in a way which is quite impossible in the unimpregnated state, and the recent researches of Hélie (p. 51) enable us to understand much better than before how the muscles forming the walls of the gravid uterus act during the expulsion of the child. The changes in the mucous coat of the uterus, which result in the formation of the decidua, have already been discussed at length elsewhere (p. 86).

The circulatory apparatus of the uterus during pregnancy has been described when the anatomy of the placenta was under consideration (p. 99).

The lymphatics are also much increased in size; and recent theories on the production of certain puerperal diseases attribute to them a more important action than has been commonly assigned to them.

The question of the growth of the nerves has been hotly discussed. Robert Lee takes the foremost place among those who maintain that the nerves of the uterus share the general growth of its other constituent parts. Dr. Snow Beck, however, believes that they remain of the same size as in the unimpregnated state; and this view is supported by Hirschfeld, Robin, and other recent writers. Robin thought that there was an apparent increase in the size of the nerve-tubes, which, however, is really due to increase in the neurilemma. Kilian describes the nerves as increasing in length but not in thickness, while Schroeder states that they participate equally with the lymphatics in the enlargement the latter undergo. Whichever of these views may ultimately be found to be correct, it is certain that analogy would lead us to expect an increase of nervous as well as of vascular supply.

It is not in the uterus alone that pregnancy is found to produce modifications of importance. There are few of the more important functions of the body which are not, to a greater or less extent, affected; to some of these modifications it is necessary briefly to direct attention, inasmuch as, when carried to excess, they produce those disorders which often complicate gestation, and which prove so distressing and even dangerous to the patients. Such of them as are apparent and may aid us in diagnosis are discussed in the chapter which treats of the signs and symptoms of pregnancy; in this place it is only necessary to refer to those which do not properly fall into that category.

Changes in the Blood.—Amongst those which are most constant and important are the alterations in the composition of the blood. The opinion of the profession on this subject has, of late years, undergone a remarkable change. Formerly it was universally believed that pregnancy was, as the rule, associated with a condition analogous to plethora, and that this explained many characteristic phenomena of common occurrence, such as headache, palpitation, singing in the ears, shortness of breath, and the like. As a consequence, it was the habitual custom, not yet by any means entirely abandoned, to treat pregnant women on an antiphlogistic system, to place them on low diet, to administer lowering remedies, and very often to practise venesection, sometimes to a surprising extent. Thus, it was by no means rare for women to be bled six or eight times during the latter months, even when no definite symptoms existed; and many of the older authors record cases where depletion was practised every fortnight, as a matter of routine, and, when the symptoms were well marked, even from fifty to ninety times in the course of a single pregnancy.

Numerous careful analyses have conclusively proved that the composition of the blood during pregnancy is very generally—perhaps it would not be too much to say always—profoundly altered. Thus, it is found to be more watery, that its serum is deficient in albumen, and especially that the amount of colored globules is materially diminished, averaging, according to the analyses of Becquerel and Rodier, 111.8 against 127.2 in the non-gravid state. At the same time the amount of fibrine and of extractive matter is considerably increased. The latter observation is of peculiar importance, as it goes far to explain the frequency of certain thrombotic affections observed in connection with pregnancy and delivery; this hyperinosis of the blood is also considerably increased after labor by the quantity of effete material thrown into the mother's system at that time, to be got rid of by her emunctories. The truth is, that the blood of the pregnant woman is generally in a state much more nearly approaching the condition of anæmia than of plethora, and it is certain that most of the phenomena attributed to plethora may be explained equally and better on this view. These changes are much more strongly marked at the latter end of pregnancy than at its commencement, and it is interesting to observe that it is then that the concomitant phenomena alluded to are most frequently met with. Cazeaux, to whom we are chiefly indebted for insisting on the practical bearing of these views, contends that the pregnant state is essentially one analogous to chlorosis, and that it should be so treated. Objection has not unnaturally been taken to this view, as implying that a healthy and normal function is associated with a morbid state, and it has been suggested that this deteriorated state of the blood may be a wise provision of nature instituted for a purpose we are not as yet able to understand. It may certainly be admitted that pregnancy, in a perfectly healthy state of the system, should not be associated with phenomena in themselves in any degree morbid. It must not be forgotten, however, that our patients are seldom, we might safely say never, in a state that is physiologically healthy. The influence of civilization, climate, occupation, diet, and a thousand other disturbing causes that, to a greater or less degree, are always to be met with, must not be left out of consideration. Making every allowance, therefore, for the undoubted fact that pregnancy *ought* to be a perfectly healthy condition, it must be conceded, I think, that in the vast majority of cases coming under our notice it is not entirely so; and the deduction drawn by Cazeaux, from the numerous analyses of the blood of pregnant women, seems to point strongly to the conclusion that the general blood-state is one of poverty and anæmia, and that a depressing and antiphlogistic treatment is distinctly contra-indicated.

Modifications in Certain Viscera.—Closely connected with the altered condition of the blood is the physiological hypertrophy of the heart, which is now well known to occur during pregnancy. This was first pointed out by Larcher, in 1828, and it has been since verified by numerous observers. It seems to be constant and considerable, and to be a purely physiological alteration intended to meet the increased exigencies of the circulation which the complex vascular arrangements of the gravid uterus produce. The hypertrophy is limited to the left ventricle, the right ventricle, as well as both auricles, being unaffected. Blot estimates that the whole weight of the heart increases one-fifth during gestation. According to Duroziez,[1] the heart remains enlarged during lactation, but diminishes in size immediately after delivery in women who do not suckle, while in women who have borne many children it remains permanently somewhat larger than in nulliparæ. Similar increase in the size of other organs has been pointed out by various writers, as, for example, in the lymphatics, the spleen, and the liver. Tarnier states that in women who have died after delivery, the organs always show signs of fatty degeneration. According to Gaisnier, the whole body increases in weight during the latter months of pregnancy, and this increase is somewhat beyond that which can be explained by the size of the womb and its contents.

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[1] Gaz. des Hôpit., 1868.

Formation of Osteophytes.—Irregular bony deposits between the skull and the dura mater, in some cases so largely developed as to line the whole cranium, have been very frequently detected in women who have died during parturition, so that they are believed by some to be a normal production connected with pregnancy. Ducrest found these osteophytes in more than one-third of the cases in which he performed post-mortem examinations during the puerperal period. Rokitansky, who corroborated the observation, believed this peculiar deposit of bony matter to be a physiological and not a pathological condition connected with pregnancy; but whether it be so, or how it is produced, has not yet been satisfactorily determined.

Changes in the Nervous System.—More or less marked changes connected with the nervous system are generally observed in pregnancy, and sometimes to a very great extent. When carried to excess they produce some of the most troublesome disorders which complicate gestation, such as alterations in the intellectual functions, changes in the disposition and character, morbid cravings, dizziness, neuralgia, syncope, and many others. They are purely functional in their character, and disappear rapidly after delivery, and may be best described in connection with the disorders of pregnancy.

Respiration is often interfered with, from the mechanical results of the pressure of the enlarged uterus. The longitudinal dimensions of the thorax are lessened by the upward displacement of the diaphragm, and this necessarily leads to some embarrassment of the respiration, which is, however, compensated, to a great extent, by an increase in breadth of the base of the thoracic cavity.

Changes in the Urine.—Certain changes, which are of very constant occurrence, in the urine of pregnant women have attracted much attention, and have been considered by many writers to be pathognomonic of that state. They consist in the presence of a peculiar deposit, formed when the urine has been allowed to stand for some time, which has received the name of *kiestinè*. Its presence was known to the ancients, and it was particularly mentioned by Savonarola in the fifteenth century, but it has more especially been studied within the last thirty years by Eguisier, Golding Bird, and others. If the urine of a pregnant woman be allowed to stand in a cylindrical vessel, exposed to light and air, but protected from dust, in a period varying from two to seven days a peculiar flocculent sediment, like fine cotton-wool, makes its appearance in the centre of the fluid, and soon afterwards rises to the surface and forms a pellicle, which has been compared to the fat on cold mutton-broth. In the course of a few days the scum breaks up and falls to the bottom of the vessel. On microscopic examination it is found to be composed of fat-particles, with crystals of ammoniaco-magnesian phosphates and phosphate of lime, and a large quantity of vibriones. These appearances are generally to be detected after the second month of pregnancy, and up to the seventh or eighth month, after which they are rarely produced. Regnault explains their absence during the latter months of gestation by the presence in the urine, at that time, of free lactic acid, which is generally present as a result of the presence of certain of the constituents of the milk in the urine, which increases its acidity, and prevents the decomposition of the urea into carbonate of ammonia. He believes that kiestine is produced by the action of free carbonate of ammonia on the phosphate of lime contained in the urine, and that this reaction is prevented by the excess of acid.

Golding Bird believed kiestine to be analogous to casein, to the presence of which he referred it, and he states that he has found it in twenty-seven out of thirty cases. Braxton Hicks so far corroborates his view, and states that the deposit of kiestine can be much more abundantly produced if one or two teaspoonfuls of rennet be added to the urine, since that substance has the property of coagulating casein. Much less importance, however, is now attached to the presence of kiestine than formerly, since a precisely similar substance is sometimes found in the urine unconnected with pregnancy, especially in anæmic women, and even in the urine of men. Parkes states that it is not of uniform composition, but that it is produced by the decomposition of urea, and consists of the free phosphates, bladder mucus, fatty infusoria, and vaginal discharges. Neugebauer and Vogel give a similar account of it, and hold that it is of no diagnostic value. That it is of interest, as indicating the changes going on in connection with pregnancy, is certain; but, inasmuch as it is not of invariable occurrence, and may even exist quite independently of gestation, it is obviously quite undeserving of the extreme importance that has been attached to it.

CHAPTER IV.

SIGNS AND DIAGNOSIS OF PREGNANCY.

IN attempting to ascertain the presence or absence of pregnancy, the practitioner has before him a problem which is often beset with great difficulties, and on the proper solution of which the moral character of his patient, as well as his own professional reputation, may depend. Those who are interested in the result of the enquiry can hardly be expected to appreciate the fact that it is often far from easy to give a positive opinion on the point; and it is always advisable to use much caution in the examination, and not to commit ourselves to a positive opinion, except on the most certain grounds. This is all the more important, because it is just in those cases in which our opinion is most frequently asked, that the statements of the patient are of least value, as she is either anxious to conceal the existence of pregnancy, or, if desirous of an affirmative diagnosis, unconsciously colors her statements, so as to bias the judgment of the examiner.

Constant attempts have been made to classify the signs of pregnancy: thus, some divide them into the *natural* and *sensible* signs, others into the *presumptive*, the *probable*, and the *certain*. The latter division, which is that adopted by Montgomery in his classical work on the "Signs and Symptoms of Pregnancy," is no doubt the better of the two, if any classification be required. The simplest way of studying the subject, however, is the one, now generally adopted, of considering the signs of pregnancy in the order in which they occur, and attaching to each an estimate of its diagnostic value.

From the earliest ages authors have thought that the occurrence of conception might be ascertained by certain obscure symptoms, such as the peculiar appearance of the eyes, swelling of the neck, or unusual sensations connected with a fruitful intercourse. All of these, it need hardly be said, are far too uncertain to be of the slightest value. The last, however, is a sign on which many married women profess themselves able to depend, and one to which Cazeaux is inclined to attach some importance.

Cessation of Menstruation.—The first appreciable indication of pregnancy, on which any dependence can be placed, is the cessation of the customary menstrual discharge, and it is of great importance, as forming the only reliable guide for calculating the probable period of delivery. In women who have been previously perfectly regular, in whom there is no morbid cause which is likely to have caused its suppression, its non-appearance may be taken as strong presumptive evidence of the existence of pregnancy; but it can never be more than this, unless verified and strengthened by other signs, inasmuch as there are many conditions besides pregnancy which may lead to its non-appearance. Thus, exposure to cold, mental emotion, general debility, especially when connected with incipient phthisis, may all have this effect. Mental impressions are peculiarly liable to mislead in this respect. It is far from uncommon in newly-married women to find that menstruation ceases for one or more periods, either from the general disturbance of the system connected with the married life, or from a desire on the part of the patient to find herself pregnant. Also in unmarried women, who have subjected themselves to the risk of impregnation, mental emotion and alarm often produce the same result.

Menstruation during Pregnancy.—A further source of uncertainty exists in the fact that in certain cases menstruation may go on for one or more periods after conception, or even during the whole pregnancy. The latter circumstance is certainly of extreme rarity, but one or two instances are recorded by Perfect, Churchill, and other writers of authority, and therefore its possibility must be admitted. The former is much less uncommon, and instances of it have probably come under the observation of most practitioners. The explanation of it is now well understood. During the early months of gestation, when the ovum is not yet sufficiently advanced in growth to fill the whole uterine cavity, there is a considerable space between the decidua reflexa which surrounds it and the decidua vera lining the uterine cavity. It is from this that the periodical discharge comes, and there is not only ample space for it to come from, but a free channel for its escape through the os uteri. After the third month, however, the decidua reflexa and the decidua vera blend together, and the space between them disappears. Menstruation after this time is, therefore, much more difficult to account for. It is probable that, in many supposed cases, occasional losses of blood from other sources, such as placenta prævia, an abraded cervix uteri, or a small polypus, have been mistaken for true menstruation. If the discharge really occurs periodically after the third month, it can only come from the canal of the cervix. The occurrence, however, is so rare, that if a woman is menstruating regularly and normally, who believes herself to be more than four months advanced in pregnancy, we are justified *ipso facto* in negativing the supposition. In an unmarried woman all statements as to regularity of menstruation are absolutely valueless, for in such cases nothing is more common than for the patient to make false statements for the express purpose of deception.

Pregnancy may unquestionably occur when menstruation is normally absent. This is far from uncommon in women who conceive during lactation, when the function is in abeyance, and who therefore have no reliable data for calculating the true period of their delivery. Authentic cases are also recorded in which young girls have conceived before menstruation is established, and in which pregnancy has occurred after the change of life. Taking all these facts into account, we can only look upon the cessation of menstruation as a fairly presumptive sign of pregnancy in women in whom there is no clear reason to account for it, but one which is of undoubtedly great value in assisting our diagnosis.

Sympathetic Disturbances.—Shortly after conception various sympathetic disturbances of the system occur, and it is only very exceptionally that these are not established. They are generally most developed in women of highly nervous temperament; and they are, therefore, most marked in patients in the upper classes of society, in whom this class of organization is most common.

Amongst the most frequent of these are various disorders of the gastro-intestinal canal. A tendency to nausea and vomiting is very general; and, as it is generally felt on first rising from the recumbent position, it is popularly known amongst women as the "morning sickness." It sometimes commences almost immediately after conception, but more frequently it does not show itself until the second month, and it rarely lasts after the fourth month. Generally it is a sense of nausea rather than actual vomiting. The woman feels sick and unable to eat her breakfast, and often brings up some glairy fluid. In other cases, however, she actually vomits, and sometimes the sickness is so excessive as to resist all treatment, seriously to affect the patient's health, and even imperil her life. These grave forms of the affection will require separate consideration. Very different opinions have been held as to the cause of morning sickness. Dr. Henry Bennet believes that, when at all severe, it is always associated with congestion and inflammation of the cervix uteri. Dr. Graily Hewitt maintains that it depends entirely on flexion of the uterus, producing irritation of the uterine nerves at the seat of the flexion, and consequent sympathetic vomiting. This theory, however, when broached at the Obstetrical Society, was received with little favor; and it seems to me to be sufficiently disproved by the fact, which I believe to be certain, that more or less nausea is a normal and nearly constant phenomenon in pregnancy; and it is difficult to believe that nearly every pregnant woman has a flexed uterus. The generally received explanation is probably the correct one, viz., that nausea, as well as other forms of sympathetic disturbances, depends on the stretching of the uterine fibres by the growing ovum, and the consequent irritation of the uterine nerves. It is, therefore, one, and only one, of the numerous reflex phenomena naturally accompanying pregnancy. It is an old observation that, when the sickness of pregnancy is entirely absent, other and generally more distressing sympathetic derangements are often met with, such as a tendency to syncope. Dr. Bedford[1] has laid especial stress on this point, and maintains that such women are peculiarly apt to miscarry.

Other derangements of the digestive functions, depending on the same cause, are not uncommon, such as excessive or depraved appetite, the patient showing a craving for strange and even disgusting articles of diet. These cravings may be altogether irresistible, and are popularly known as "longings." Of a similar character is the disturbed condition of the bowels frequently observed, leading to constipation, diarrhœa, and excessive flatulence.

Certain glandular sympathies may be developed, one of the most common being an excessive secretion from the salivary glands. A tendency to syncope is not unfrequent, rarely proceeding to actual fainting, but rather to that sort of partial syncope, unattended with complete loss of consciousness, which the older authors used to call "lypothemia." This often occurs in women who show no such tendency at other times, and, when developed to any extent, forms a very distressing accompaniment of pregnancy. Toothache is common, and is not rarely associated with actual caries of the teeth. When any of these phenomena are carried to excess, it is more than probable that some morbid condition of the uterus exists, which increases the local irritation producing them.

Mental peculiarities are very general. An undue degree of despondency, utterly beyond the patient's control, is far from uncommon; or a change which renders the bright and good-tempered woman fractious and irritable; or even the more fortunate but less common change by which a disagreeable disposition becomes altered for the better. All these phenomena of exalted nervous susceptibility, however, are but of slight diagnostic value. They may be taken as corroborating more certain signs, but nothing more; and they are chiefly interesting from their tendency to be carried to excess and to produce serious disorders.

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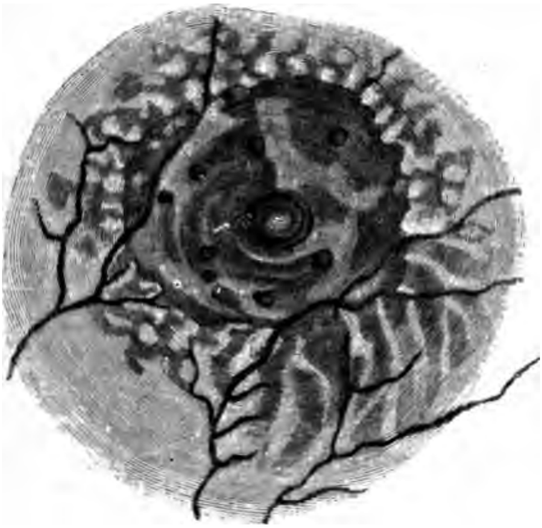
[1] Diseases of Women and Children, p. 551.

Mammary Changes.—Certain changes in the mammæ are of early occurrence, dependent, no doubt, on the intimate sympathetic relations at all times existing between them and the uterine organs, but chiefly required for the purpose of preparing for the important function of lactation, which, on the termination of pregnancy, they have to perform.

These changes generally commence about the second month of pregnancy, when the breasts become increased in size and tender. As pregnancy advances, they become much larger and firmer, and blue veins may be seen crossing over them. The most characteristic changes, however, are about the *nipples* and *areolæ*, and on these many authors have laid great stress. The nipples become turgid, and are frequently covered with minute branny scales, formed by the desiccation of sero-lactescent fluid oozing from them. The areolæ surrounding them become greatly enlarged and darkened from the deposit of pigment (Fig. 71). The extent of this discoloration varies much in different women. In fair women it may be so slight as to be hardly appreciable, while in dark women it is generally exceedingly characteristic, sometimes forming a nearly black circle extending over a great part of the breast. The areola becomes moist as well as dark in appearance, and is somewhat swollen, and a number of small tubercles become developed upon it, forming a circle of projections around the nipple. These tubercles are described by Montgomery as being intimately connected with the lactiferous ducts, some of which may occasionally be traced into them and seen to open on their summits. As pregnancy advances,

FIG. 71.



APPEARANCE OF THE AREOLA IN PREGNANCY.

they increase in size and number. During the latter months what has been called "*the secondary areola*" becomes developed, and when well marked forms a very characteristic appearance. It consists of a number of minute discolored spots all round the areola where the pigmentation is fainter, and which are generally described as resembling spots from which the color had been discharged by a shower of water-drops. This change, like the darkening of the primary areola, is most marked in brunettes. At this period, especially in women whose skin is of fine texture, whitish silvery streaks are often seen on the breasts. They are produced by the stretching of the cutis vera, and are permanent.

By pressure on the breasts a small drop of serous-looking fluid can very generally be pressed out from the nipple often as early as the third month, and on microscopic examination milk and colostrum globules can be seen in it.

The *diagnostic value* of these mammary changes has been variously estimated. When well marked, they are considered by Montgomery to be certain signs of pregnancy. To this statement, however, some important limitations must be made. In women who have never borne children they, no doubt, are so; for, although various uterine and ovarian diseases produce some darkening of the areola, they certainly never produce the well-marked changes above described. In multiparæ, however, the areolæ often remain permanently darkened, and in them these signs are much less reliable. The presence of milk in the breasts in first pregnancies may be considered an almost certain sign, and it is one which I have rarely failed to detect even from a comparatively early period. It is true that there are authenticated instances of non-pregnant women having an abundant secretion of milk established from mammary irritation. Thus, Baudelocque presented to the Academy of Surgery of Paris a young girl eight years of age, who had nursed her little brother for more than a month. Dr. Tanner states—I do not know on what authority—that "it is not uncommon in Western Africa for young girls who have never been pregnant to regularly employ themselves in nursing the children of others, the mammæ being excited to action by the application of the juice of one of the euphorbiaceæ." Lacteal secretion has even been noticed in the male breast. But these are exceptions to the general rule so uncommon as merely to deserve mention as curiosities; and I have never yet been deceived in diagnosing a first pregnancy from the presence of even the minutest quantity of lacteal secretion in the breasts, although even then other corroborative signs should always be sought for. In multiparæ the presence of milk is by no means so valuable, for it is common for milk to remain in the mammæ long after the cessation of lactation, and even for several years. Dr. Tyler Smith correctly says that "suppression of the milk in persons who are nursing and liable to impregnation is a more valuable sign of pregnancy than the converse condition." This is an observation I have frequently corroborated.

As a diagnostic sign of pregnancy, therefore, the mammary symptoms are of great importance in primiparæ, and in them, when well marked, they are seldom likely to deceive. They are specially important when we suspect pregnancy in the unmarried, as we can easily make an excuse to look at the breast without explaining to the patient the reason; and a single glance, especially if the patient be dark-complexioned, may so far strengthen our suspicion as to justify a more thorough examination. In married multiparæ they are of less consequence and less reliable.

In connection with this subject may be mentioned various irregular deposits of pigment which are frequently observed during pregnancy. The most common is a dark brownish or yellowish line starting from the pubes and running up the centre of the abdomen, sometimes as far as the umbilicus only, at others splitting into two, so as to form an irregular ring round the umbilicus, and reaching to the epigastrium. It is, however, of very uncertain occurrence, being well marked in some women, while in others it is entirely absent. Patches of darkened skin are often observed about the face, chiefly on the forehead, and this bronzing of the skin sometimes gives a very peculiar appearance. Joulin states that it only occurs on parts of the face exposed to the sun, and that it is therefore most frequently observed in women of the lower order, who are freely exposed to atmospheric influences. These pigmentary changes are of small diagnostic value, and they may be present for a considerable time after delivery.

The progressive enlargement of the abdomen, and the size of the gravid uterus at various periods of pregnancy, as well as the method of examination by means of abdominal palpation, have already been described (pp. 109 and 119).

In connection with this subject we have to refer to the well-known phenomena produced by the movements of the fœtus in utero, which are so familiar to all pregnant women. These, no doubt, take place from the earliest period of fœtal life at which the muscular tissue of the fœtus is sufficiently developed to admit of contraction, but they are not felt by the mother until somewhere about the sixteenth week of utero-gestation, the precise period at which they are perceived varying considerably in different cases. The errors of the law on this subject, which supposes the child not to be alive, or "quick," until the mother feels its movements, are well known, and have frequently been made the subject of protest by the medical profession. The so-called *quickening*, which certainly is felt very suddenly by some women, is believed to depend on the rising of the uterine tumor sufficiently high to permit of the impulse of the fœtus being transmitted to the abdominal walls of the mother, through the sensory nerves of which its movements become appreciable. The sensation is generally described as being at first a feeble fluttering, which, when first felt, not unfrequently causes unpleasant nervous or hysterical sensations. As the uterus enlarges, the movements become more and more distinct, generally consisting of a series of sharp blows or kicks, sometimes quite appreciable to the naked eye, and causing distinct projection of the abdominal walls. Their force and intensity will also vary during the pregnancy, according to circumstances. At times they are very frequent and distressing, at others the fœtus seems to be comparatively quiet, and its movements may even not be felt for several days in succession, and thus unnecessary fears as to the death of the fœtus often arise. The state of the mother's health has an undoubted influence in promoting them. They are said to increase in force after a prolonged abstinence from food, or in certain positions of the body. It is certain that causes interfering with the vitality of the fœtus often produce very irregular and tumultuous movements. They can be very readily felt by the accoucheur on palpating the abdomen, and sometimes, in the latter months, so distinctly as to leave no doubt as to the existence of pregnancy. They can also generally be induced by placing one hand on each side of the abdomen and gently pressing inwards with one of them, when the pressure will induce fœtal motion, which the other hand easily appreciates.

As a diagnostic sign the existence of fœtal movements has always held a high place, but care should be taken in relying on it. It is certain that women are themselves very often in error, and fancy they feel the movements of a fœtus when none exists, being probably deceived by irregular abdominal contractions, or flatus within the bowels. They may even involuntarily produce such intra-abdominal movements as may readily deceive the practitioner. Of course, in advanced pregnancy, when the fœtal movements are so marked as to be seen as well as felt, a mistake is hardly possible, and they then constitute a certain sign. But in such cases there is an abundance of indications and little room for doubt. In questionable cases, and at an earlier period of pregnancy, the absence of movements must not be taken as a proof of the non-existence of pregnancy, for they may be so feeble as not to be perceptible, or they may be absent for a considerable period.

Dr. Braxton Hicks[1] has recently directed attention to the value, in a diagnostic point of view, of intermittent contractions of the uterus during pregnancy. He has pointed out that, after the uterus is sufficiently large to be felt by palpation, if the hand be placed over it, and it be grasped for a time without using any friction or pressure, it will be observed to distinctly harden in a manner that is quite characteristic. This intermittent contraction occurs every five or ten minutes, sometimes oftener, rarely at longer intervals. The fact that the uterus did contract in this way had been previously described, more especially by the late Dr. Tyler Smith, who ascribed it to peristaltic action. But it is certain that no one, before Dr. Hicks, had pointed out the fact that such contractions were constant and normal concomitants of pregnancy, continuing during the whole period of utero-gestation, and forming a ready and reliable means of distinguishing the uterine tumor from other abdominal enlargements. Since reading Dr. Hicks's paper I have paid considerable attention to this sign, which I have never failed to detect, even in the retroflexed gravid uterus contained entirely in the pelvic cavity, and I am disposed entirely to agree with him as to its great value in diagnosis. If the hand be kept steadily on the uterus, its alternate hardening and relaxation can be appreciated with the greatest ease. The advantage which this sign has over the fœtal movements is that it is constant, that it is not liable to be simulated by anything else, and that it is independent of the life of the child, being equally appreciable when the uterus contains a degenerated ovum or dead fœtus. The only condition likely to give rise to error is an enlargement of the uterus in consequence of contained foreign bodies other than the results of conception, such as retained menses, or a polypus. The history of such cases—which are, moreover, of extreme rarity—would easily prevent any mistake. As a corroborative sign of pregnancy, therefore, I should give these intermittent contractions a high place.

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[1] Obst. Trans., v. 13.

The *vaginal signs* of pregnancy are of considerable importance in diagnosis. They are chiefly the changes which may be detected in the cervix, and the so-called *ballottement* which depends on the mobility of the fœtus in the liquor amnii.

The alterations in the density and apparent length of the cervix have been already described (p. 121). When pregnancy has advanced beyond the fifth month, the peculiar velvety softness of the cervix is very characteristic, and affords a strong corroborative sign, but one which it would be unsafe to rely on by itself, inasmuch as very similar alterations may be produced by various causes. When, however, in a supposed case of pregnancy advanced beyond the period indicated, the cervix is found to be elongated, dense, and projecting into the vaginal canal, the non-existence of pregnancy may be safely inferred; and therefore the negative value of this sign is of more importance than the positive.

Ballottement, when distinctly made out, is a very valuable indication of pregnancy. It consists in the displacement, by the examining finger, of the fœtus, which floats up in the liquor amnii, and falls back again on the tip of the finger with a slight tap which is exceedingly characteristic.

Method of Examination.—In order to practise it most easily, the patient is placed on a couch or bed in a position midway between sitting and lying, by which the vertical diameter of the uterine cavity is brought into correspondence with that of the pelvis. Two fingers of the right hand are then passed high up into the vagina in front of the cervix. The uterus being now steadied from without by the left hand, the intravaginal fingers press the uterine wall suddenly upwards, when, if pregnancy exists, the fœtus is displaced, and in a moment falls back again, imparting a distinct impulse to the fingers. When easily appreciable, it may be considered as a certain sign, for although an ante-flexed fundus, or a calculus in the bladder, may give rise to somewhat similar sensations, the absence of other indications of pregnancy would readily prevent error. Ballottement is practised between the fourth and seventh months. Before that time the fœtus is too small, while at a later period it is relatively too large, and can no longer be easily made to rise upwards in the surrounding liquor amnii. The absence of ballottement must not be taken as proving the non-existence of pregnancy, for it may be inappreciable from a variety of causes, such as abnormal presentations, or the implantation of the placenta over the cervix uteri.

There are also some other vaginal signs of pregnancy of secondary consequence. Amongst these is the vaginal pulsation, pointed out by Osiander, which depends on the enlargement of the vaginal arteries, which may sometimes be felt beating at an early period. Often this pulsation is very distinct, at other times it cannot be felt at all, and it is altogether unreliable, as a similar pulsation may be felt in various uterine diseases.

Dr. Rasch has lately drawn attention to a previously undescribed sign which he believes to be of importance in the diagnosis of early pregnancy.[1] It consists in the detection of fluctuation through the anterior uterine wall, depending on the presence of the liquor amnii. In order to make this out, two fingers of the right hand must be used, as in ballottement, while the uterus is steadied through the abdomen. Dr. Rasch states that by this means the enlarged uterus in pregnancy can easily be distinguished from the enlargement depending on other causes, and that fluctuation can always be felt as early as the second month. If it is associated with suppressed menstruation and darkened areolæ, he considers it a certain sign. In order to detect it, however, considerable experience in making vaginal examinations is essential; and it can hardly be depended on for general use.

A peculiar deep violet hue of the vaginal mucous membrane was relied on by Jacquemier and Klüge as affording a readily-observed indication of pregnancy. In most cases it is well marked; sometimes, indeed, the change of color is very intense, and it evidently depends on the congestion produced by pressure of the enlarged uterus. The same effect, however, is constantly seen where similar pressure is effected by large fibroid tumors of the uterus, and, therefore, for diagnostic purposes it is valueless.

Auscultation.—By far the most important signs are those which can be detected by abdominal auscultation, and one of these—the hearing of the fœtal heart-sounds—forms the only sign which *per se*, and in the absence of all others, is perfectly reliable.

The fact that the sounds of the fœtal heart are audible during advanced pregnancy was first pointed out by Mayor of Geneva in 1818, and the main facts in connection with fœtal auscultation were subsequently worked out by Kergaradec, Naegele, Evory Kennedy, and other observers. The pulsations first become audible, as a rule, in the course of the fifth month, or between it and the fourth month. In exceptional circumstances, and by practised observers, they have been heard earlier. Depaul believes that he detected them as early as the eleventh week, and Routh has also detected them at an early period by vaginal stethoscopy, which, however, for obvious reasons, cannot be ordinarily employed. Naegele never heard them before the eighteenth week, more generally at the end of the twentieth, and for practical purposes the pregnancy must be advanced to the fifth month before we can reasonably expect to detect them. From this period up to term they can almost always be heard, if not at the first attempt, at least afterwards, to a certainty, if we have the opportunity of making repeated examinations. Accidental circumstances, such as the presence of an unusual amount of flatus in the intestines, may deaden the sounds for a time, but not permanently. Depaul only failed to hear them in eight cases out of 906 examined during the last three months of pregnancy; and out of 180 cases, which Dr. Anderson of Glasgow carefully examined, he only failed to hear the fœtal heart in twelve, and in each of these the child was still-born. They therefore form not only a most certain indication of pregnancy, but of the life of the fœtus also.

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[1] Brit. Med. Jour., vol. ii., 1823.

The sound has been always likened to the double tic-tac of a watch heard through a pillow, which it closely resembles. It consists of a distinct double beat, separated by a short interval, the first being the loudest and most distinct, the second being sometimes inaudible. The rapidity of the fœtal pulsations forms an important means of distinguishing them from transmitted maternal pulsations, with which they might be confounded. Their average number is stated by Slater, who made numerous observations on this point, to be 132, but sometimes reaching as high as 140, and sometimes as low as 120. It will thus be seen that the pulsations are always much more rapid than those of the mother's heart, unless, indeed, the latter be unduly accelerated by transient mental emotion or disease. To avoid mistakes, whenever the fœtal heart is heard its rate of pulsation should be carefully counted, and compared with that of the mother's pulse; if the rates differ, we may be sure that no error has been made. The rapidity of the fœtal pulsations remains, as a rule, the same during the whole period of pregnancy, while their intensity gradually increases. They may, however, be temporarily increased or diminished in frequency by disturbing causes, such as the pressure of the stethoscope, which, exciting tumultuous movements of the fœtus, may induce greatly-increased frequency of its heart-beats. So also during labor, after the rupture of the liquor amnii, when the contractions of the uterus have a very distinct influence on the fœtus, they may be greatly modified. An acceleration or irregularity of the pulsations, made out in the course of a prolonged labor, may thus be of great practical importance, by indicating the necessity for prompt interference. Similar alterations, associated with tumultuous and unusual fœtal movements felt by the mother towards the end of pregnancy, may point to danger to the life of the fœtus during the latter months, and may even justify the indication of premature labor. This is especially the case in women who have previously given birth to a succession of dead children owing to disease of the placenta, and, in them, careful and frequently repeated auscultations may warn us of the impending danger.

The rapidity of the fœtal heart-sounds has been supposed by some to afford a means of determining the sex of the child before birth. Frankenhauser, who first directed attention to this point, is of opinion that the average pulsations of the heart are considerably less in male than in female children, averaging 124 in the minute in the former, as against 144 in the latter. Steinbach makes the difference between the average number of beats somewhat less, viz., 131 for males, and 138 for females. He predicted the sex correctly by this means in 45 out of 57 cases, while Frankenhauser was correct in the whole 50 cases which he specially examined with reference to the point. Dr. Hutton, of New York, was also correct in seven cases he fixed on for trial.[1] Devilliers found the average in the sexes to be the same as Steinbach; he attributes the difference, however, to the size and weight rather than to the sex of the child, and believes the pulsations to be least numerous in large and well-developed children. As male children are usually larger than female, he thus explains the relatively less frequent pulsations of their hearts. The point, however, is more curious than practical, and the rapidity of the pulsations certainly would not justify any positive prediction on the subject. Circumstances influencing the maternal circulation seem to have no influence on that of the fœtus.

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[1] New York Med. Jour., July, 1872.

The fœtal heart-sounds are generally propagated best by the back of the child, and are, therefore, most easily audible when this is in contact with the anterior wall of the uterus, as is the case in the large majority of pregnancies. When the child is placed in the dorso-posterior position, the sounds have to traverse a large amount of the liquor amnii, and are further modified by the interposition of the fœtal limbs. They are, therefore, less easily heard in such cases; but even in them they can almost always be made out. As the fœtus most frequently lies with the occiput over the brim of the pelvis, and the back of the child towards the left side of the mother, the heart-sounds are usually most distinctly audible at a point midway between the umbilicus and the left anterior-superior spine of the ilium. In the next most common position, in which the back of the child lies to the right lumbar region of the mother, they are generally heard at a corresponding point at the right side, but in this case they are frequently more readily made out in the right flank, being then transmitted through the thorax of the child, which is in contact with the side of the uterus. In breech cases, on the other hand, the heart-sounds are generally heard most distinctly *above* the umbilicus, and either to the right or left, according to the side towards which the back of the child is placed. It will thus be seen that the place at which the fœtal heart-sounds are heard varies with the position of the fœtus itself; and this, when combined with palpation, affords a ready means of ascertaining the presentation of the child before labor. The sounds are only audible over a limited space, about two to three inches in diameter; therefore, if we fail to detect them in one place, a careful exploration of the whole uterine tumor is necessary before we are satisfied that they cannot be heard.

Sources of Fallacy.—The only mistake that is likely to be made is taking the maternal pulsations, transmitted through the uterine tumor, for those of the fœtal heart. A little care will easily prevent this error, and the frequency of the mother's pulse should always be ascertained before counting the supposed fœtal pulsations. If these are found to be 120 or more, while the mother's pulse is only 70 or 80, no mistake is possible. If the latter is abnormally quickened, greater care may be necessary, but even then the rate of pulsation of each will be dissimilar. Dr. Hicks[1] has pointed out that in tedious labor, when the muscular powers of the mother are exhausted, the muscular subsurrus may produce a sound closely resembling the fœtal pulsation; but error from this source is obviously very improbable.

Mode of Practising Auscultation.—In listening for the fœtal heart-sounds the patient should be placed on her back, with the shoulders elevated and the knees flexed. The surface of the abdomen should be uncovered, and an ordinary stethoscope employed, the end of which must be pressed firmly on the tumor, so as to depress the abdominal walls. The most absolute stillness is necessary, as it is often far from easy to hear the sounds. Sometimes, after failing with the ordinary stethoscope, I have succeeded with the bin-aural, which remarkably intensifies them. When once heard, they are most easily counted during a space of five seconds, as, on account of their frequency, it is not always possible to follow them over a longer period.

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[1] Obst. Trans., vol. xv.

When once the fœtal heart-sounds are heard distinctly, pregnancy may be absolutely and certainly diagnosed. The fact that we do not hear them does not, however, preclude the possibility of gestation, for the fœtus may be dead, or the sounds temporarily inaudible.

There are some other sounds heard in auscultation which are of very secondary diagnostic value. One of these is the so-called *umbilical or funic souffle,* which was first pointed out by Evory Kennedy. It consists of a single blowing murmur, synchronous with the fœtal heart-sounds, and most distinctly heard in the immediate vicinity of the point where these are most audible. Most authors believe it to be produced by pressure on the cord, either when it is placed between a hard part of the fœtus and the uterine walls, or is twisted round the child's neck. Schroeder and Hecker detected it in fourteen or fifteen per cent. of all cases, and the latter believed it to be caused by flexure of the first portion of the cord near the umbilicus. For practical purposes it is quite valueless, and need only be mentioned as a phenomenon which an experienced auscultator may occasionally detect.

The *uterine souffle* is a peculiar single whizzing murmur, which is almost always audible on auscultation. It varies very remarkably in character and position. Sometimes it is a gentle blowing or even musical murmur; at others it is loud, harsh, and scraping; sometimes continuous, sometimes intermittent. It may also be heard at any point of the uterus, but most frequently low down, and to one or other side; more rarely above the umbilicus, or towards the fundus; and it often changes its position so as to be heard at a subsequent auscultation at a point where it was previously inaudible. It may be heard over a space of an inch or two only, or, in some cases, over the whole uterine tumor; or again, it may sometimes be detected simultaneously over two entirely separate portions of the uterus. It is generally to be heard earlier than the fœtal heart-sounds, often as soon as the uterus rises above the brim of the pelvis, and it can almost always be detected after the commencement of the fourth month. The sound becomes curiously modified by the uterine contractions during labor, becoming louder and more intense before the pain comes on, disappearing during its acme, and again being heard as it goes off. Hicks attributes to a similar cause, viz., the peculiar uterine contractions going on during pregnancy, the frequent variations in the sound which are characteristic of it.[1] The uterine souffle is also audible after the death of the fœtus, and it is believed by some to be modified and to become more continuously harsh when that event has taken place.

Very various explanations have been given of the causes of this sound. For long it was supposed to be formed in the vessels of the placenta, and hence the name "*placental souffle,*" by which it is often talked of; or, if not in the placenta, in the uterine vessels in its immediate neighborhood. The non-placental origin of the sound is sufficiently demonstrated by the fact that it may be heard for a considerable time after the expulsion of that viscus. Some have supposed that it is not formed in the uterus at all, but in the maternal vessels, especially the aorta and the iliac arteries, owing to the pressure to which they are subjected by the gravid uterus. The extreme irregularity of the sound, its occasional disappearance, and its variety of situation over different parts of the uterus, seem to be conclusive against this view. The theory which refers the sound to the uterine vessels themselves is that which has received most adherents, and which best meets the facts of the case; but it is by no means easy or even possible to account for the exact mode of its production in them. Each of the explanations which have been given is open to some objection. It is far from unlikely that the intermittent contractions of the uterine fibres, which are known to occur during the whole course of pregnancy, may have much to do with it, by modifying, at intervals, the rapidity of the circulation in the vessels. Its production in this manner may also be favored by the chlorotic state of the blood, to which Cazeaux and Scanzoni are inclined to attribute an important influence in its causation, likening it to the anæmic murmur so frequently heard in the vessels in weakly women.

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[1] Op. cit., p. 228.

From a diagnostic point of view the uterine souffle is of very secondary importance, because a similar sound is very generally audible in large fibroid tumors of the uterus, and even in some few ovarian tumors; it is, therefore, of little or no value in assisting us to decide the character of the abdominal enlargement.

The supposed dependence of the sound on the placental circulation has caused its site to be often identified with that of the placenta. It is, however, most frequently heard at the lower part of the uterus, while the placenta is generally attached near the fundus; so that its position cannot be taken as any safe guide in determining the situation of that viscus.

Occasionally, in practising auscultation, irregular sounds of brief duration may be heard, which are not susceptible of accurate description, and which doubtless depend on the sudden movements of the fœtus in the liquor amnii, or on the impulse of its limbs on the uterine walls. When heard distinctly, they are characteristic of pregnancy, and afford strong corroborative proof of its existence; and they may be sometimes heard when the other sounds cannot be detected. They are, however, so irregular, and so often [illegible] that they can hardly be looked upon [illegible] phenomena which may occasionally be detected.

Two other sounds have been described as being sometimes audible, which may be mentioned [illegible] are of no diagnostic value. [illegible] be audible in cases [illegible] decomposition of the liquor [illegible] extremely problematical. [illegible] child, and referred by Ca[illegible]. He describes [illegible] similar to those which would [illegible] the seat of a sofa. Simpson[1] admits the existence of the sound, but believes that it is produced by the mere physical crushing of the placenta, and artificially imitated it out of the body by forcing the placenta through an aperture the size of the os uteri.

It will be seen, then, that although there are numerous symptoms accompanying pregnancy, many of them are unreliable by themselves, and apt to mislead. Those which may be confidently depended on are the pulsations of the fœtal heart, which, however, fail us in cases of dead children; the fœtal movements when distinctly made out by the examiner; ballottement; the intermittent contractions of the uterus; and to these we may safely add lacteal secretions in the breasts, provided we have to do with a first pregnancy.

The remainder are of importance in leading us to suspect pregnancy, and in corroborating and strengthening other symptoms, but they do not, of themselves, justify a positive diagnosis.

CHAPTER V.

THE DIFFERENTIAL DIAGNOSIS OF PREGNANCY.—SPURIOUS PREGNANCY.—THE DURATION OF PREGNANCY.—SIGNS OF RECENT DELIVERY.

THE differential diagnosis of pregnancy has of late years assumed much importance on account of the advances of abdominal surgery. The cases are so numerous in which even the most experienced practitioners have fallen into error, and in which the abdomen has been laid open in ignorance of the fact that pregnancy existed, that the subject becomes one of the greatest consequence. Fortunately it is less so from an obstetrical than from a gynæcological point of view, inasmuch as the converse error, of mistaking some other condition for pregnancy, is of far less consequence, as it is one which time will always rectify. But even in this way carelessness may lead to very serious injury to the character, if not to the health, of the patient; and it will be well to refer briefly to some of the conditions most liable to be mistaken for pregnancy, and to the mode of distinguishing them.

Adipose enlargement of the abdomen may obscure the diagnosis by preventing the detection of the uterus; and if, as is not uncommon in women of great obesity, it is associated with irregular menstruation, the increased size of the abdomen might be erroneously supposed to depend on pregnancy. The absence of corroborative signs, however, such as auscultatory phenomena or mammary changes, and the hardness of the cervix as felt per vaginam, make it easy to avoid this error.

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[1] Selected Obstet. Works, p. 151.

Distension of the uterus by retained menstrual fluid, or watery secretion, is an occurrence of rarity, that could seldom give rise to error. Still, it undoubtedly occasionally happens that the uterus becomes enlarged in this way, sometimes reaching even to the level of the umbilicus, and the physical character of the uterine tumor is not unlike that of the gravid uterus. The best safeguard against mistakes will be the previous history of the case, which will always be different from that of ordinary pregnancy. Retained menstruation almost always occurs from some physical obstruction to the exit of the fluid, such as imperforate hymen, which has prevented the appearance of the discharge; or if it occurs in women who have already menstruated, we may usually trace a history of some cause, such as inflammation following an antecedent labor, which has produced occlusion of some part of the genital tract. The existence of a uterine tumor in a girl who has never menstruated will of itself give rise to suspicion, as pregnancy under such circumstances is of extreme rarity. It will also be found that general symptoms have existed for a period of time considerably longer than the supposed duration of pregnancy, as judged of by the size of the tumor. The most characteristic of them are periodic attacks of pain due to the addition, at each monthly period, to the quantity of retained menstrual fluid. Whenever, from any of these reasons, suspicion of the true character of the case has arisen, a careful vaginal examination will generally clear it up. In most cases the obstruction will be in the vagina, and is at once detected, the vaginal canal above it, as felt per rectum, being greatly distended by fluid, and we may also find the bulging and imperforate hymen protruding through the vulva. The absence of mammary changes, and of ballottement, will materially aid us in forming a diagnosis.

The *engorged and enlarged uterus*, frequently met with in women suffering from uterine disease, might readily be mistaken for an early pregnancy, if it happened to be associated with amenorrhœa. A little time would, of course, soon clear up this mistake, by showing that progressive increase in size, as in pregnancy, does not take place. This mistake, however, could only be made at an early stage of pregnancy, when a positive diagnosis is never possible. The accompanying symptoms—pain, inability to walk, and tenderness of the uterus on pressure —would further prevent such an error.

Ascites, *per se*, could hardly be mistaken for pregnancy, for the uniform distension and evident fluctuation, the absence of any definite tumor, the resonant percussion at the most elevated portion of the abdomen, its alteration in accordance with change of position, and the unchanged cervix and uterus, should be sufficient to clear up any doubt. Pregnancy may, however, exist with ascites, and this combination may be difficult to detect, and might readily be mistaken for ovarian disease, associated with ascites. The existence of mammary changes, the presence of the softened cervix, ballottement, and auscultation, provided the sounds were not masked by the surrounding fluid, would afford the best means of diagnosing such a case.

Uterine and Ovarian Tumors.—One of the most frequent sources of difficulty is the differential diagnosis of large abdominal tumors, either fibroid or ovarian, or of some enlargements due to malignant disease of the peritoneum or abdominal viscera. The most experienced have been occasionally deceived under such circumstances. As a rule, the presence of menstruation will prevent error, as this generally continues in ovarian disease, while in fibroids it is often excessive. The character of the tumor, the fluctuation in ovarian disease, the hard nodular masses in fibroid, and the history of the case, especially the length of time the tumor has existed, will aid in diagnosis, while the absence of cervical softening and of auscultatory phenomena will further be of material value in forming a conclusion. Some of the most difficult cases to diagnose are when pregnancy complicates ovarian or fibroid disease. Then the presence of the tumor may more or less completely obscure the physical signs of pregnancy. The usual shape of the abdomen will generally be altered considerably, and we may be able to distinguish the gravid uterus, separated from the ovarian tumor by a distinct sulcus, or with the fibroid masses cropping out from its surface. Our chief reliance must then be placed in the alterations of the cervix, and in the detection of the auscultatory signs of pregnancy.

The condition most likely to give rise to errors, however, is that very interesting and peculiar state known as *spurious pregnancy*. In this most of the usual phenomena of pregnancy are so strangely simulated that accurate diagnosis is often far from easy. There are hardly any of the more apparent symptoms of pregnancy which may not be present in marked cases of this kind. The abdomen may become prominent, the areolæ altered, menstruation arrested, and apparent fœtal motions may be observed; and, unless suspicion is aroused, and a careful physical examination made, both the patient and the practitioner may easily be deceived. There is no period of the child-bearing life in which spurious pregnancy may not be met with; but it is most likely to occur in elderly women about the climacteric period, when it is generally associated with ovarian irritation connected with the change of life; or in younger women, who are either very desirous of finding themselves pregnant, or who, being unmarried, have subjected themselves to the chance of being so. In either of these cases the mental faculties have much to do with its production, and there is generally either very marked hysteria, or even a mental condition closely allied to insanity. Spurious pregnancy is by no means confined to the human race. It is well known to occur in many of the lower animals. Harvey related instances in bitches, either after unsuccessful intercourse, or in connection with the rut, even when no intercourse had occurred. In such cases the abdomen swelled, and milk appeared in the mammæ. Similar phenomena are also occasionally met with in the cow. In these instances, as in the human female, there is probably some morbid irritation of the ovarian system.

Its Signs and Symptoms.—The physical phenomena are often very well marked. The appearance of enlargement is sometimes very great, and it seems to be produced by a projection forward of the abdominal contents due to depression of the diaphragm, together with rigidity of the abdominal muscles, and may even simulate closely the feeling of the uterine tumor on palpation. After the climacteric it is frequently associated, as Gooch pointed out, with an undue deposit of fat in the abdominal walls and omentum, so that there may be even some dulness on percussion, instead of resonance of the intestines, thus still further leading to error. The fœtal movements are curiously and exactly simulated, either by involuntary contractions of the abdominal walls, or by the movement of flatus in the intestines. The patient also generally fancies that she suffers from the usual sympathetic disorders of pregnancy, and thus her account of her symptoms will still further tend to mislead.

Not only may the supposed pregnancy continue, but, at what would be the natural term of delivery, all the phenomena of labor may supervene. Many authentic cases are on record in which regular pains came on, and continued to increase in force and frequency until the actual condition was diagnosed. Such mistakes, however, are only likely to happen when the statements of the patient have been received without further enquiry. When once an accurate examination has been made, error is no longer possible.

Diagnosis.—We shall generally find that some of the phenomena of pregnancy are absent. Possibly menstruation, more or less irregular, may have continued. Examination per vaginam will at once clear up the case, by showing that the uterus is not enlarged, and that the cervix is unaltered. It may then be very difficult to convince the patient or her friends that her symptoms have misled her, and for this purpose the inhalation of chloroform is of great value. As consciousness is abolished, the semi-voluntary projection of the abdominal muscles is prevented, the large apparent tumor vanishes, and the bystanders can be readily convinced that none exists. As the patient recovers, the tumor again appears.

The *duration of pregnancy* in the human female has always formed a fruitful theme for discussion amongst obstetricians. The reasons which render the point difficult of decision are obvious. In the large majority of cases occurring in married women, in whom intercourse occurs frequently, there is no means of knowing the precise period at which conception took place. The only datum which exists for the calculation of the probable date of delivery is the cessation of menstruation. It is quite possible, however, and indeed probable, that conception occurred, in a considerable number of instances, not immediately after the last menstruation, but immediately before the proper epoch for the occurrence of the next. As the interval between the end of one menstruation and the commencement of the next averages 25 days, an error to that extent is always possible. Another source of fallacy is the fact, which has generally been overlooked, that even a single coitus does not fix the date of conception, but only that of insemination. It is well known that in many of the lower animals the fertilization of the ovule does not take place until several days after copulation, the spermatozoa remaining in the interval in a state of active vitality within the genital tract. It has been shown by Marion Sims that living spermatozoa exist in the cervical canal in the human female some days after intercourse. It is very probable, therefore, that in the human female, as in the lower animals, a considerable but unknown interval occurs between insemination and actual impregnation, which may render calculations as to the precise duration of pregnancy altogether unreliable.

A large mass of statistical observations exist respecting the average duration of gestation, which have been drawn up and collated from numerous sources. It would serve no practical purpose to reprint the voluminous tables that are contained in obstetrical works on this subject. They are based on two principal methods of calculation. First, we have the length of time between the cessation of menstruation and delivery. This is found to vary very considerably, but the largest percentage of deliveries occurs between the 274th and 280th day after the last appearance of menstruation, the average being on the 278th day; but, in individual instances, very considerable variations both above and below these limits are found to exist. Next we have a series of cases, from various sources, in which only one coitus was believed to have taken place. These are naturally always open to some doubt, but, on the whole, they may be taken as affording tolerably fair grounds for calculation. Here, as in the other mode of calculation, there are marked variations, the average length of time, as estimated from a considerable collection of cases, being 275 days after the single intercourse. It may, therefore, be taken as certain that there is no definite time which we can calculate on as being the proper duration of pregnancy, and, consequently, no method of estimating the probable date of delivery on which we can absolutely rely. The prediction of the time at which the confinement may be expected is, however, a point of considerable practical importance, and one on which the medical attendant is always consulted. Various methods of making the calculation have been recommended.

It has been customary in this country, according to the recommendation of Montgomery, to fix upon ten lunar months, or 280 days, as the probable period of gestation, and, as conception is supposed to occur shortly after the cessation of menstruation, to add this number of days to any day within the first week after the last menstrual period as the most probable period of delivery. As, however, 278 days is found to be the average duration of gestation after the cessation of menstruation, and as this method makes the calculation vary from 281 to 287 days, it is evidently liable to fix too late a date. Naegele's method was to count seven days from the first appearance of the last menstrual period, and then reckon backwards three months as the probable date. Thus, if a patient last commenced to menstruate on August 10, counting in this way from August 17 would give May 17 as the probable date of the delivery.

Dr. Matthews Duncan has paid more attention than any one else to the prediction of the date of delivery. His method of calculating is based on the fact of 278 days being the average time between the cessation of menstruation and parturition; and he claims to have had a greater average of success in his predictions than on any other plan. His rule is as follows:—"Find the day on which the female ceased to menstruate, or the first day of being what she calls 'well.' Take that day nine months forward as 275, unless February is included, in which case it is taken as 273 days. To this add three days in the former case, or five if February is in the count, to make up the 278. This

278th day should then be fixed on as the middle of the week, or, to make the prediction the more accurate, of the fortnight, in which the confinement is likely to occur, by which means allowance is made for the average variation of either excess or deficiency."

Various periodoscopes and tables for facilitating the calculation have been made. That of Dr. Tyler Smith (sold by Messrs. John Smith, 52 Long Acre) is very useful for reference in the consulting-room, giving at a glance a variety of information, such as the probable period of quickening, the dates for the induction of premature labor, &c. The following is also easily read, and is very serviceable:—

TABLE FOR CALCULATING THE PERIOD OF UTERO-GESTATION.[1]

Nine Calendar Months			Ten Lunar Months	
From	To	Days	To	Days
Jan. 1	Sept 30	273	Oct. 7	280
Feb. 1	Oct. 31	273	Nov. 7	280
Mar. 1	Nov. 30	275	Dec. 5	280
April 1	Dec. 31	275	Jan. 5	280
May 1	Jan. 31	276	Feb. 4	280
June 1	Feb. 28	273	Mar. 7	280
July 1	Mar. 31	274	Apr. 6	280
Aug. 1	Apr. 30	273	May 7	280
Sept. 1	May 31	273	June 7	280
Oct. 1	June 30	273	July 7	280
Nov. 1	July 31	273	Aug. 7	280
Dec. 1	Aug. 31	274	Sept. 6	280

The date at which the quickening has been perceived is relied on by many practitioners, and still more by patients, in calculating the probable date of delivery, as it is generally supposed to occur at the middle of pregnancy. The great variations, however, in the time at which this phenomenon is first perceived, and the difficulty which is so often experienced of ascertaining its presence with any certainty, render it a very fallacious guide. The only times at which the perception of quickening is likely to prove of any real value are when impregnation has occurred during lactation (when menstruation is normally absent), or when menstruation is so uncertain and irregular that the date of its last appearance cannot be ascertained. As quickening is most commonly felt during the fourth month, more frequently in its first than in its last fortnight, it may thus afford the only guide we can use, and that an uncertain one, for predicting the date of delivery.

Protracted Gestation.—From a medico-legal point of view the question of the possible protraction of pregnancy beyond the average time, and of the limits within which such protraction can be admitted, is of very great importance. The law on this point varies considerably in different countries. Thus, in France it is laid down that legitimacy cannot be contested until 300 days have elapsed from the death of the husband, or the latest possible opportunity for sexual intercourse. This limit is also adopted by Austria, while in Prussia it is fixed at 302 days. In England and America no fixed date is admitted, but, while 280 days is admitted as the "legitimum tempus pariendi," each case in which legitimacy is questioned is to be decided on its own merits. At the early part of the century the question was much discussed by the leading obstetricians in connection with the celebrated Gardner peerage case, and a considerable difference of opinion existed among them. Since that time many apparently perfectly reliable cases have been recorded in which the duration of gestation was obviously much beyond the average, and in which all sources of fallacy were carefully excluded.

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[1] The above obstetric "Ready Reckoner" consists of two columns, one of calendar, the other of lunar months, and may be read as follows. A patient has ceased to menstruate on July 1: her confinement may be expected at soonest about March 31 (*the end of nine calendar months*), or at latest on April 6 (*the end of ten lunar months*). Another has ceased to menstruate on January 20: her confinement may be expected on September 30, plus 20 days [illegible] *of nine calendar months*), at soonest, or on October 7, plus 20 days (*the* [illegible] *nar months*), at latest.

Not to burden these pages with a number of cases, it may suffice to refer, as examples of protraction, to four well-known instances recorded by Simpson,[1] in which the pregnancy extended to 336, 332, 319, and 324 days after the cessation of the last menstruation. In these, as in all cases of protracted gestation, there is the possible source of error that impregnation may have occurred just before the expected advent of the next period. Making an allowance of 23 days in each instance for this, we even then have a number of days much above the average, viz., 313, 309, 296, and 301. Numerous instances as curious may be found scattered through obstetric literature. Indeed, the experience of most accoucheurs will parallel such cases, which may be more common than is generally supposed, inasmuch as they are only likely to attract attention when the husband has been separated from the wife beyond the average and expected duration of the pregnancy.

The evidence in favor of the possible prolongation of gestation is greatly strengthened by what is known to occur in the lower animals. In some of these, as in the cow and the mare, the precise period of insemination is known to a certainty, as only a single coitus is permitted. Many tables of this kind have been constructed, and it has been shown that there is in them a very considerable variation. In some cases in the cow it has been found that delivery took place 45 days, and in the mare 43 days, after the calculated date. Analogy would, therefore, go strongly to show that what is known to a certainty to occur in the lower animals may also take place in the human female. The fact, indeed, is now very generally admitted; but we are still unable to fix, with any degree of precision, on the extreme limit to which protraction is possible. Some practitioners have given cases in which, on data which they believe to be satisfactory, pregnancy has been extremely protracted: thus, Meigs and Adler record instances which they believed to have been prolonged to over a year in one case, and over fourteen months in the other. These are, however, so problematical that little weight can be attached to them. On the whole, it would hardly be safe to conclude that pregnancy can go more than three or four weeks beyond the average time. This conclusion is justified by the cases we possess in which pregnancy followed a single coitus, the longest of which was 295 days.

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[1] Obstet. Memoirs, p. 84.

Dr. Duncan[1] is inclined to refuse credence to every case of supposed protraction unless the size and weight of the child are above the average, believing that lengthened gestation must of necessity cause increased growth of the child. The point requires further investigation, and it cannot be taken as proved that the fœtus necessarily must be large because it has been retained longer than usual in utero; or, even if this be admitted, it may have been originally small, and so, at the end of the protracted gestation, be little above the average weight. There are, however, many cases which certainly prove that a prolonged pregnancy is at least often associated with an unusually developed fœtus. Dr. Duncan himself cites several; and a very interesting one is mentioned by Leishman, in which delivery took place 295 days after a single coitus, the child weighing 12 lb. 3 oz.

It seems possible that in some cases of protracted pregnancy labor actually came on at the average time, but, on account of faulty positions of the uterus, or other obstructing cause, the pains were ineffective and ultimately died away, not recurring for a considerable time. Joulin relates some instances of this kind. In one of them the labor was expected from the 20th to the 25th of October. He was summoned on the 23d, and found the pains regular and active, but ineffective; after lasting the whole of the 24th and 25th, they died away, and delivery did not take place until November 25th, after the lapse of a month. In this instance the apparent cause of difficulty was extreme anterior obliquity of the uterus. A precisely similar case came under my own observation. The lady ceased to menstruate on March 16th, 1870. On December 12th—that is, on the 273d day—strong labor pains came on, the os dilated to the size of a florin, and the membranes became tense and prominent with each pain. After lasting all night, they gradually died away, and did not recur until January 12th, 304 days from the cessation of the last period. Here there was no assignable cause of obstruction, and the labor, when it did come on, was natural and easy.

The curious fact that in both these cases, as in others of the same kind that are recorded, labor came on exactly a month after the previous ineffectual attempt at its establishment, affords, so far as it goes, an argument in favor of the view maintained by many that labor is apt to come at what would have been a menstrual period.

Signs of Recent Delivery.—From a forensic point of view it often becomes of importance to be able to give a reliable opinion as to the fact of delivery having occurred; and a few words may be here said as to the signs of recent delivery. Our opinion is only likely to be sought in cases in which the fact of delivery is denied, and in which we must, therefore, entirely rely on the results of a physical examination. If this be undertaken within the first fortnight after labor, a positive conclusion can be readily arrived at.

At this time the abdominal walls will still be found loose and flaccid, and bearing very evident marks of extreme distension in the cracks and fissures of the cutis vera. These remain permanent for the rest of the patient's life, and may be safely assumed as signs of an antecedent pregnancy, provided we can be certain that no other cause of extreme abdominal distension has existed, such as ascites, or ovarian tumor.

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[1] Fecundity and F[illegible] p. 348.

Within the first few days after delivery, the hard round ball formed by the contracted and empty uterus can readily be felt by abdominal palpation, and more certainly by combined external and internal examination. The process of involution, however, by which the uterus is reduced to its normal size, is so rapid that after the first week it can no longer be made out above the brim of the pelvis. In cases in which an accurate diagnosis is of importance, the increased length of the uterus can be made out by the uterine sound, and its cavity will measure more than the normal 2½ inches for at least a month after delivery. It should not be forgotten that the uterine parietes are now undergoing fatty degeneration, and that they are more than usually soft and friable, so that the sound should be used with great caution, and only when a positive opinion is essential. The state of the cervix and of the vagina may afford useful information. Immediately after delivery the cervix hangs loose and patulous in the vagina, but it rapidly contracts, and the internal os is generally entirely closed after the eighth or tenth day. The remainder of the cervix is longer in returning to its normal shape and consistency. It is generally permanently altered after delivery, the external os remaining fissured and transverse, instead of circular with smooth margins, as in virgins. The vagina is at first lax, swollen, and dilated, but these signs rapidly disappear, and cannot be satisfactorily made out after the first few days. The absence of the fourchette may be recognized, and is a persistent sign.

The existence of the lochia affords a valuable sign of recent delivery. For the first few days they are sanguineous, and contain numerous blood corpuscles, epithelial scales, and the débris of the decidua. After the fifth day they generally change in color, and become pale and greenish, and from the eighth or ninth day till about a month after delivery they have the appearance of a thick opalescent mucus. They have, moreover, a peculiar heavy, sickening odor, which should prevent their being mistaken for either menstruation or leucorrhœal discharge.

The appearance of the breasts will also aid the decision, for it is impossible for the patient to conceal the turgid swollen condition of the mammæ, with the darkened areolæ, and, above all, the presence of milk. If on microscopic examination the milk is found to contain colostrum corpuscles, the fact of very recent delivery is certain. In women who do not nurse it should be remembered that the secretion of milk often rapidly disappears, so that its absence cannot be taken as a sign that delivery has not taken place. On the whole, there should be no difficulty in deciding that a woman has been delivered, as some of the signs are persistent for the rest of her life; but it is not so easy, unless we see the case within the first eight or ten days, to say how long it is since labor took place.

CHAPTER VI.

ABNORMAL PREGNANCY, INCLUDING MULTIPLE PREGNANCY, SUPERFŒTATION, EXTRA-UTERINE FŒTATION, AND MISSED LABOR.

THE occurrence of more than one fœtus in utero is far from uncommon, but there are circumstances connected with it which justify the conclusion that plural births must not be classified as natural forms of pregnancy. The reasons for this statement have been well collected by Dr. Arthur Mitchell,[1] who conclusively shows that not only is there a direct increase of risk both to the mother and her offspring, but that many abnormalities, such as idiocy, imbecility, and bodily deformity, occur with much greater frequency in twins than in single-born children. He concludes that "the whole history of twin births is exceptional, indicates imperfect development and feeble organization in the product, and leads us to regard twinning in the human species as a departure from the physiological rule, and therefore injurious to all concerned."

The *frequency of multiple births* varies considerably under different circumstances. Taking the average of a large number of cases collected by authors in various countries, we find that twin pregnancies occur about once in 87 labors; triplets once in 7679. A certain number of quadruple pregnancies, and some cases of early abortion in which there were five fœtuses, are recorded, so that there can be no doubt of the possibility of such occurrences; but they are so extremely uncommon that they may be looked upon as rare exceptions, the relative frequency of which can hardly be determined.

The frequency of multiple pregnancy varies remarkably in different races and countries. The following table[2] will show this at a glance:

RELATIVE FREQUENCY OF MULTIPLE PREGNANCIES IN EUROPE.

Countries.	Proportion of Twin to Single Births.	Proportion of Triplets.	Proportion of Quadruplets.
England	1 : 116	1 : 6720	—
Austria	1 : 94	—	—
Grand Duchy of Baden . . .	1 : 89	1 : 6575	—
Scotland	1 : 95	—	—
France	1 : 99	1 : 8256	1 : 2,074,306
Ireland	1 : 64	1 : 4995	1 : 167,296
Mecklenburg-Schwerin . . .	1 . 68.9	1 : 6436	1 : 183,236
Norway	1 : 81.62	1 : 5442	—
Prussia	1 : 89	1 : 7820	1 : 394,690
Russia	1 : 50.05	1 : 4054	—
Saxony	1 : 79	1 : 1000	1 : 400,000
Switzerland	1 : 102	—	—
Würtemberg	1 : 862	1 : 6464	1 : 110,991

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[1] Med. Times and Gaz., Nov. 1862.

[2] Puech, Des Naissances Multiples.

It will be seen that the largest proportion of multiple births occurs in Russia, and that the relative proportion of triple births is greatest where twin pregnancies are most frequent. Puech concludes that the number of multiple pregnancies is in direct proportion to the general fecundity of the inhabitants.

Dr. Duncan has deduced some interesting laws, with regard to the production of twins, from a large number of statistical observations,[1] especially that the tendency to the production of twins increases as the age of the woman advances, and is greater in each succeeding pregnancy, exception being made for the first pregnancy, in which the tendency to multiple births is greater than in any other. Newly-married women appear more likely to have twins the older they are. There can be no doubt that there is often a strong hereditary tendency in individual families to the production of twins. A remarkable instance of this kind is recorded by Mr. Curgenven,[2] in which a woman had four twin pregnancies, her mother and aunt each one, and her grandmother two. Simpson mentions a case of quadruplets, consisting of three males and one female, who all survived, the female subsequently herself giving birth to triplets.[3]

Sex.—In the largest number of cases of twins the children are of opposite sexes, next most frequently there are two females, and twin males are the most uncommon. Thus, out of 59,178 labors, Simpson calculates that twin male and female occurred once in 199 labors, twin females once in 226, and twin males once in 258. The relative proportion of male to female births is also notably less in twin than in single pregnancies.

Weight.—Twins, and *a fortiori* triplets, are almost always comparatively smaller and less perfectly developed than single children. Thus the chances of the survival of these children are much less, and Clarke calculates the mortality amongst twins as one out of thirteen. In triplets, indeed, it is comparatively rare that all the children survive, while in quadruplets premature labor and the death of the fœtuses are almost certain. It is a common observation that twins are often unequally developed at birth. By some this difference is attributed to one of the fœtuses being of a different age to the other. It is probable, however, that in most of these cases the full development of one fœtus has been interfered with by pressure of the other. This is far from uncommonly carried to the extent of destroying one of the twins, which is expelled at term, mummified and flattened between the living child and the uterine wall. In other cases when one fœtus dies it may be expelled without terminating the pregnancy, the other twin being retained in utero and born at term. Those who disbelieve in the possibility of superfœtation place the cases in which it is believed to have occurred under this category.

Causes.—Multiple pregnancies depend on various causes. The most common is probably the simultaneous, or nearly simultaneous, maturation and rupture of two Graafian follicles, the ovules becoming impregnated at or about the same time. It by no means necessarily follows, even if more than one follicle should rupture at once, that both ovules should be impregnated. This is proved by the occurrence of cases in which there are two corpora lutea with only one fœtus. There are numerous facts to prove that ovules thrown off within a short time of each other may become separately impregnated, as in cases in which negro women have given birth to twins, one of which was pure negro, the other half-caste.

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[1] On Fecundity, Fertility, and Sterility, p. 99.

[2] Obst. Trans., vol. xi.

[3] Obst. Works, p. 830.

It may happen, however, that a single Graafian follicle contains more than one ovule, as has actually been observed before the rupture of the vesicle; or, as is not uncommon in the egg of the fowl, the same ovule may contain a double germ, each of which may give rise to a separate fœtus.

The various modes in which twins may originate explain satisfactorily the variations which are met with in the arrangement of the fœtal membranes, and in the form and connections of the placentæ.

In a large proportion of cases there are two distinct bags of membranes, the septum between the two being composed of four layers, viz., the chorion and amnion of each ovum. The placentæ are also entirely separate from each other. Here it is obvious that the twins are developed from distinct ova, each with its own chorion and amnion. On arriving in the uterus it is probable that each ovum became fixed independently in the mucous membrane, and was surrounded by its own decidua reflexa. As growth advances, however, the decidua reflexa most generally atrophies from pressure, as it is not usual to find more than four layers of membrane in the septum separating the ova. In other cases we meet with only one chorion, within which are two distinct amnions, the septum then consisting of two layers only. Here the placentæ are generally in close apposition, and become fused into a single mass; the cords, separately attached to each fœtus, not unfrequently uniting shortly before reaching the placental mass, their vessels anastomosing freely with each other. In other more rare instances both fœtuses are contained in a common amniotic sac; but, as the amnion is a purely fœtal membrane, it is probable that, when this arrangement is met with, the originally existing septum between the amniotic sacs has been accidentally destroyed. In both these latter cases the twins must have been developed from a single ovule containing a double germ, and Schroeder states that they are then always of the same sex. Dr. Brunton[1] has started a precisely opposite theory, and has tried to prove that twins of the same sex are contained in separate bags of membrane, while twins of opposite sexes have a common sac. He says that out of twenty-five cases coming under his observation, in fifteen the children contained in different sacs were of the same sex, but in the remaining ten, in which there was only one sac, they were of opposite sexes. It is difficult to believe that there is not an error in these observations, since twins contained in a single amniotic sac do not occur nearly as often as ten times out of twenty-five cases, and no distinction is made between a common chorion with two amnions and a single chorion and amnion. The facts of double monstrosity also disprove this view, since these must of necessity arise from a single ovule with a double germ, and there is no instance on record in which they were of opposite sexes.

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[1] Obst. Trans., vol. x.

In triplets the membranes and placentæ may be all separate, or, as is commonly the case, there is one complete bag of membranes, and a second having a common chorion, with a double amnion. It is probable, therefore, that triplets are generally developed from two ovules, one of which contained a double germ.

Diagnosis of Multiple Pregnancy.—It is comparatively seldom that twin pregnancy can be diagnosed before the birth of the first child, and, even when suspicion has arisen, its indications are very defective. There is generally an unusual size of the uterine tumor, and an irregularity of shape, sometimes even a distinct depression or sulcus between the two bodies. When the latter exists, it may be possible to make out parts of each fœtus by palpation on either side of the uterus. The only sign, however, on which the least reliance can be placed is the detection of two fœtal hearts. If two distinct pulsations are heard at different parts of the uterine tumor; if, on carrying the stethoscope from one point to another, there is an interspace where the pulsations are no longer audible, or where they become feeble, again increasing in clearness as the second point is reached; and, above all, if we are able to make out a difference in frequency between them, the diagnosis is tolerably safe. It must be remembered, however, that the sounds of the same heart may be heard over a larger space than usual, and hence a possible source of error. Twin pregnancy, moreover, may readily exist without the most careful auscultation enabling us to detect a double pulsation, especially if one child lies in the dorso-posterior position, when the body of the other may prevent the transmission of the sound. The so-called placental souffle is too often diffuse and irregular to be of any use in diagnosis, even when it is distinctly heard at separate parts of the uterus.

Closely connected with the subject of multiple pregnancies are the conditions known as *superfecundation* and *superfœtation*, regarding which there has been much controversy and difference of opinion.

By the former is meant the fecundation, at or near the same period of time, of two separate ovules before the decidua lining the uterus has been formed, which by many is supposed to form an insuperable obstacle to subsequent impregnation. The possibility of this occurrence can hardly be reasonably doubted, and it has been incontestably proved by the class of cases already referred to, in which the same woman has given birth to fœtuses bearing evident traces of being the offspring of fathers of different races.

By *superfœtation*, on the other hand, is meant the impregnation of a second ovule, when the uterus already contains an ovum which has arrived at a considerable degree of development. The cases which are supposed to prove the possibility of this occurrence are very numerous. They consist chiefly of those in which either a woman is delivered simultaneously of fœtuses of very different ages, one bearing all the marks of having arrived at term, the other of prematurity; or of instances in which a patient is delivered of an apparently mature child, and, after the lapse of a few months, of another equally mature. The possibility of the supposed examples of superfœtation is strongly doubted by many practitioners of eminence, and explanations are given which doubtless serve to account satisfactorily for a large proportion of them. In the former class of cases it is supposed, with much probability, that we have to do with an ordinary twin pregnancy, the development of one fœtus being retarded by the pressure or excess of another. That this is an occasional occurrence is certain, and the fact has already been alluded to in treating of twin pregnancy. In cases of the latter kind it is possible that some of them may be due to separate impregnation in a bifid uterus, the contents of one division being thrown off a considerable time before those of the other. Numerous authentic examples of this occurrence are recorded, but by far the most remarkable is that related by Dr. Ross of Brighton, which has been already referred to (p. 57). In this case the patient had previously given birth to many children without any suspicion as to her abnormal formation having arisen, and, had it not been detected by Dr. Ross, it might fairly enough have been adduced as an indubitable example of superfœtation.

Making every allowance, however, for these explanations of such cases, there remains a considerable number which it is very difficult to account for, except on the supposition that the second child has been conceived a considerable time after the first. Those interested in the subject will find a large number of examples collected in a very interesting paper by Dr. Bonnar of Cupar.[1] He has adopted the ingenious plan of consulting the records of the British peerage, where the exact date of the birth of successive children of peers is given, without, of course, any appreciable possibility of error, and he has collected numerous examples of births rapidly succeeding each other, which are apparently inexplicable by any other theory. In one case he cites, a child was born on September 14, 1840, and the mother gave birth to another on January 19, 1841, after an interval of only 127 days. Subtracting from that 14 days, which Dr. Bonnar assumes to be the earliest possible period at which a fresh impregnation can occur after delivery, we reduce the gestation to 113 days, that is, to less than four calendar months. As both these children survived, the second child could not possibly have been the result of a fresh impregnation after the birth of the first; nor could the first child have been a twin prematurely delivered, for if so it must have only reached rather more than the fifth month, at which time its survival would have been impossible.

Besides the numerous examples of cases of this kind recorded in most obstetric works, there are one or two of miscarriage in the early months, in which, in addition to a fœtus of four or five months' growth, a perfectly fresh ovum of not more than a month's development was thrown off. One such case was shown at the Obstetrical Society in 1862, which was reported on by Drs. Harley and Tanner, who stated that in their opinion it was an example of superfetation. A still more conclusive case is recorded by Tyler Smith.[2] "A young married woman, pregnant for the first time, miscarried at the end of the fifth month, and some hours afterwards a small clot was discharged, enclosing a perfectly healthy ovum of about one month. There were no signs of a double uterus in this case. The patient had menstruated regularly during the time she had been pregnant." This case is of special interest from the fact of the patient having menstruated during pregnancy—a circumstance only explicable on the same anatomical grounds which render superfœtation possible. So far as I know, it is the only instance in which the coincidence of superfœtation and menstruation during early pregnancy has been observed.

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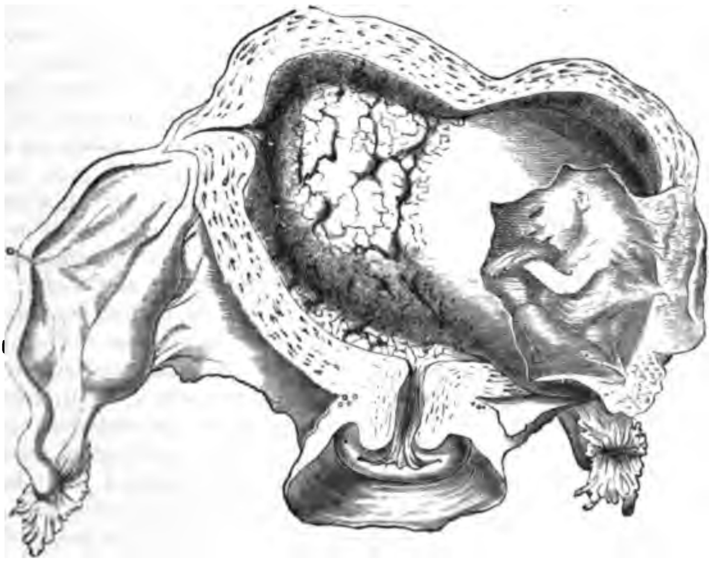
[1] Edin. Med. Jour., 1864-65.

[2] Manual of Obstetrics, p. 112.

The objections to the possibility of superfœtation are based on the assumptions that the decidua so closely fills up the uterine cavity that the passage of the spermatozoa is impossible; that their passage is further prevented by the mucous plug which blocks up the cervix in pregnancy; and that when once impregnation has taken place ovulation is suspended. It is, however, certain that none of these objections offer an insuperable obstacle. The first objection was originally based on the older and erroneous view which considered the decidua to be an exudation lining the entire uterine cavity and sealing up the mouths of the Fallopian tubes and the aperture of the internal os uteri. It is certain, however, that the decidua reflexa does not come into apposition with the decidua vera until about the eighth week of pregnancy, and, therefore, until that time there is a free space between the two membranes through which the spermatozoa might pass to the open mouth of the Fallopian tube, and in which a newly-impregnated ovule might graft itself. A reference to the accompanying figure of a pregnancy in the third month, copied from Coste's work, will readily show that, as far as the decidua is concerned, there is no mechanical obstacle to the descent

FIG. 72.



ILLUSTRATING THE CAVITY BETWEEN THE DECIDUA VERA AND THE DECIDUA REFLEXA DURING THE EARLY MONTHS OF PREGNANCY.

and lodgment of another impregnated ovule (Fig. 72). Then, as regards the plug of mucus, it is pretty certain that this is in no way different from the mucus filling the cervix in the non-pregnant state, which offers no obstacle at all to the passage of the spermatozoa. Lastly, respecting the cessation of ovulation during pregnancy, this, no doubt, is the rule, and probably satisfactorily explains the rarity of superfœtation. There are, however, a sufficient number of authenticated cases of menstruation during pregnancy to prove that ovulation is not always absolutely in abeyance; and, as long as it occurs, there is unquestionably no positive mechanical obstruction, at least in the early months of pregnancy, in the way of the impregnation and lodgment of the ovules that are thrown off. The reasonable conclusion, therefore, seems to be that, although a large majority of the supposed cases are explicable in other ways, it cannot be admitted that superfœtation is either physiologically or mechanically impossible.

Extra-Uterine Pregnancy.—The most important of the abnormal varieties of pregnancy, if we consider the serious and very generally fatal results attending it, is the so-called *extra-uterine fœtation*, which consists in the arrest and development of the ovum outside the cavity of the uterus. Of late years this subject has received much well-merited attention, which, it is to be hoped, may lead to the establishment of some definite rules for the management of this most anxious and dangerous class of cases.

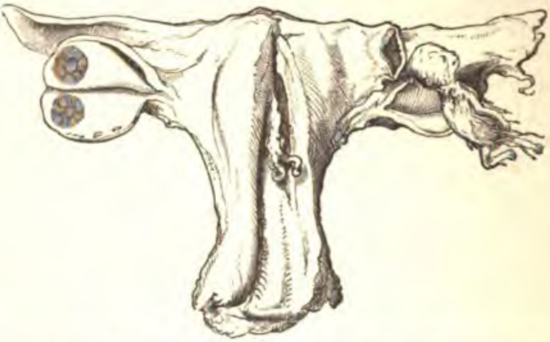
Site.—The ovum may be arrested and developed in various situations on its way to the uterus, most commonly in some part of the Fallopian tube, or it may be in the cavity of the abdomen, or even quite beyond it, as in a few rare cases in which the ovum has found its way into a hernial sac. Extra-uterine gestation may be subdivided into the following classes: 1st, and most common of all, *tubal* gestation, and as varieties of this, although by some made into distinct classes, (*a*) *interstitial* and (*b*) *tubo-ovarian* gestation. In the former of these subdivisions the ovum is arrested in the part of the Fallopian tube that is situated in the substance of the uterine parietes, in the latter, at or near the fimbriated extremity of the tube—so that part of its containing cyst is formed by the structure of the tube and part by the ovary. 2d. *Abdominal gestation*, in which an ovum, instead of finding its way into the tube, through some accident falls into the peritoneal cavity, there to attach and develop itself; or the so-called secondary abdominal gestation, in which an extra-uterine gestation, originally tubal, becomes ventral, through rupture of its cyst and escape of its contents into the abdominal cavity. 3d. *Ovarian* pregnancy, the existence of which is denied by many writers of eminence, such as Velpeau and Arthur Farre, while it is maintained by others of equal celebrity, such as Kiwisch, Coste, and Hecker. It must be admitted that it is extremely difficult to understand how an ovarian pregnancy, in the strict sense of the word, can occur, for it implies that the ovule has become impregnated before the laceration of the Graafian follicle, through the coats of which the spermatozoa must have passed. Coste, indeed, believes that this frequently occurs; but, while spermatozoa have been detected on the surface of the ovary, their penetration into the Graafian follicle has never been demonstrated. Farre has also clearly shown that in many cases of supposed ovarian pregnancy the surrounding structures were so altered that it was impossible to trace their exact origin, and to say, to a certainty, that the extra-uterine fœtation was really within the substance of the ovary. Kiwisch gives a reasonable explanation of these cases by supposing that sometimes the Graafian follicle may rupture, but that the ovule may not be discharged but remain within it. Through the rent in the walls of the follicle the spermatozoa may thus reach and impregnate the ovule, which may develop in the situation in which it has been detained. While, therefore, it is impossible, in the face of many instances recorded by reliable authorities, to deny the existence of ovarian pregnancy, it must be considered to be a very rare and exceptional variety, which, as far as treatment and results are concerned, does not differ from tubal gestation. 4th. There are two rare varieties in which an ovum is developed either in the supplementary horn of a bi-lobed uterus, or in a hernial sac.

For the sake of clearness, we may place these varieties of extra-uterine gestation in the following tabular form:

1st. *Tubal*—
    (*a*) Interstitial, (*b*) Tubo-ovarian.
2d. *Abdominal*—
    (*a*) Primary, (*b*) Secondary.
3d. *Ovarian.*
4th. In *bi-lobed uterus, hernial*, &c.

Causes.—The etiology of extra-uterine fœtation in any individual case must necessarily be almost always obscure. Broadly speaking, it may be said that extra-uterine fœtation may be produced by any condition which prevents, or renders difficult, the passage of the ovule to the uterus, while it does not prevent the access of the semen to the ovule. Thus, inflammatory thickening of the coats of the Fallopian tubes, by lessening their calibre, but not sufficiently so to prevent the passage of the spermatozoa, may interfere with the movements of the tube which propel the ovum forward, and so cause its arrest. A similar effect may be produced by various morbid conditions, such as inflammatory adhesions, from old-standing peritonitis, pressing on the tube; obstruction of its calibre by inspissated mucus or small polypoid growths; the pressure of uterine or other tumors, and the like. The fact that extra-uterine pregnancies occur most frequently in multiparæ, and comparatively rarely in women under thirty years of age, tends to show that these conditions, which are clearly more likely to be met with in such women than in young primiparæ, have considerable influence in its causation. The disturbing effects of fright, either during coition or a few days afterwards, have been insisted on by many authors as a possible cause. Numerous cases of this kind are recorded; and, although the influence of emotion in the production of this condition is not susceptible of proof, it is not difficult to imagine that spasms of the Fallopian tubes might be produced in this way, which would either interfere with the further passage of the ovum or direct it into the abdominal cavity. The occurrence of abdominal pregnancy is probably less difficult to account for if we admit, with Coste, that the ovule becomes impregnated on the surface of the ovary itself, for there must be very many conditions which prevent the proper adaptation of the fimbriated extremity of the tube to the surface of the ovary, and, failing this, the ovum must of necessity drop into the abdominal cavity. Kiwisch[1] has pointed out that this is particularly apt to occur when the Graafian follicle develops on the posterior surface of the ovary; and, indeed, it is probable that it may be of common occurrence, and that the comparative rarity of abdominal pregnancy is due to the difficulty with which the impregnated ovule engrafts itself on the surrounding viscera. It has been shown that impregnation may actually occur in the abdominal cavity itself, of which Keller relates a remarkable instance. In this case Koeberlé had removed the body of the uterus and part of the cervix, leaving the ovaries. In the portion of the cervix that remained there was a fistulous aperture opening into the abdominal cavity, through which semen passed and produced an abdominal gestation. Several curious cases are also recorded, which have given rise to a good deal of discussion, in which a tubal pregnancy existed while the corpus luteum was on the opposite side (Fig. 73). The most probable explanation, however, is that the fimbriated extremity of the tube in which the ovum was found had twisted across the abdominal cavity and grasped the opposite ovary, in this way, perhaps, producing a flexion which impeded the progress of the ovum it had received into its canal. Tyler Smith suggested that such cases might be explained by supposing that the ovum, after reaching the uterus, failed to graft itself in the mucous membrane, but found its way into the opposite Fallopian tube. Kussmaul[2] thinks that such a passage of the ovum across the uterine cavity may be caused by the muscular erectile action or compression of the uterus, occurring shortly after conception, squeezing the yet free ovum upwards towards the opening of the opposite tube, and possibly into the tube itself.

FIG. 73.



TUBAL PREGNANCY, WITH THE CORPUS LUTEUM IN THE OVARY OF THE OPPOSITE SIDE.
The decidua is represented in the process of detachment from the uterine cavity.

Tubal Pregnancies.—The history and progress of cases of extra-uterine pregnancy are materially different according to their site, and, for practical purposes, we may consider them as forming two great classes: the tubal (with its varieties), and the abdominal, which must be separately considered.

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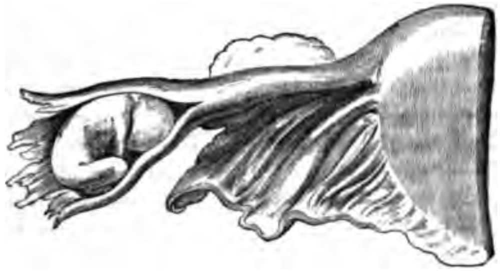
[1] Klinische Vorträge, ii. 227.

[2] Mon. f. Geburt, Oct. 1862.

When the ovum is arrested in any part of the Fallopian tube, the chorion soon commences to develop villi, just as in ordinary pregnancy, which engraft themselves into the mucous lining of the tube and fix the ovum in its new position. The mucous membrane becomes hypertrophied, much in the same way as that of the uterus under similar circumstances; so that it becomes developed into a sort of pseudo-decidua. Inasmuch, however, as this mucous coat of the tubes is not furnished with tubular glands, a true decidua can scarcely be said to exist, nor is there any growth of membrane around the ovum analogous to the decidua reflexa. The ovum is, therefore, comparatively speaking, loosely attached to its abnormal situation, and hence hemorrhage from laceration of the chorion villi can very readily take place.

It is seldom that any development of the chorion villi into distinct placental structure is observed, but this is probably owing to the fact that laceration and death generally occur before the period at which the placenta is normally formed. The muscular coats of the tube soon become hypertrophied and thickened, and, as the size of the contained ovum increases, the fibres are separated from each other, so that the ovum protrudes at certain points through them, and at these it is only covered by the stretched and attenuated mucous and peritoneal coats of the tube. At this time the tubal pregnancy forms a smooth oval tumor, which, as a rule, has not formed any adhesions to the surrounding structures (Fig. 74). The part of the tube unoccupied by the ovum may be found unaltered, and permeable in both directions; or, more frequently, it becomes so stretched and altered that its canal cannot be detected. Most frequently it is that part of the tube nearest the uterus which cannot be made out. The condition of the uterus in this, as in other forms of extra-uterine pregnancy, has been the subject of considerable discussion. It is now universally admitted that the uterus undergoes a certain amount of sympathetic engorgement, the cervix becomes softened, as in natural pregnancy, and the mucous membrane develops into a true decidua. In many cases the decidua is found on post-mortem examination, in others it is not; and hence the doubts that

FIG. 74.



CASE OF TUBAL PREGNANCY.

some have expressed as to its existence. The most reasonable explanation of its absence is that given by Duguet,[1] who has shown that it is far from uncommon for the uterine decidua to be thrown off *en masse* during the hemorrhagic discharges which so frequently precede the fatal issue of extra-uterine gestation.

When the ovum is arrested in that portion of the tube passing through the uterus, in so-called interstitial pregnancy, the muscular fibres of the uterus become stretched and distended, and form the outer covering of the ovum. When, on the other hand, the site of arrest is in the fimbriated extremity of the tube, the containing cyst is formed partly of the fimbriæ of the tube, partly of the ovarian tissue; hence it is much more distensible, and the pregnancy may continue without laceration to a more advanced period, or even to term, so that when the ovum is placed in this situation the case much more nearly resembles one of abdominal pregnancy.

The termination of tubal pregnancy, in the immense majority of cases, is death, produced by laceration, giving rise either to internal hemorrhage or to subsequent intense peritonitis. Rupture usually occurs at an early period of pregnancy, most generally from the fourth to the twelfth week, rarely later. However, a few instances are recorded in which it did not take place until the fourth or fifth month, and Saxtorph and Spiegelberg have recorded apparently authentic cases in which the pregnancy advanced to term without laceration. It is generally effected by mere straining and distension of the tube, which at last yields at the point which is most stretched, and sometimes it seems to be hastened or determined by accidental circumstances, such as a blow or fall, or the excitement of sexual intercourse.

Symptoms of Rupture.—The symptoms accompanying rupture are those of intense collapse, often associated with severe abdominal pain, produced by the laceration of the cyst. The patient will be found deadly pale, with a small, thready, and almost imperceptible pulse, perhaps vomiting, but with the mental faculties clear. If the hemorrhage be considerable, she may die without any attempt at reaction. Sometimes, however—and this generally occurs in cases in which the tube tears, the ovum remaining intact—the hemorrhage may cease on account of the ovum protruding through the aperture and acting as a plug. The patient may then imperfectly rally, to be again prostrated by a second escape of blood, which proves fatal. If the loss of blood is not of itself sufficient to cause death from shock and anæmia, the fatal issue is generally only postponed, for the effused blood soon sets up a violent general peritonitis, which rapidly carries off the patient. If she should survive the second danger, the case is transformed into one of abdominal pregnancy, the fœtus becoming surrounded by a capsule produced by inflammatory exudation, and the case is then subject to the rules of treatment presently to be discussed when considering that variety of extra-uterine gestation.

Diagnosis.—The possibility of diagnosing tubal gestation before rupture occurs is a question of great and increasing interest, from the fact that, could its existence be ascertained, we might very fairly hope to avert the almost certainly fatal issue which is awaiting the patient. Unfortunately, the symptoms of tubal pregnancy are always obscure, and too often death occurs without the slightest suspicion as to the nature of the case having arisen. In the first place, it is to be observed that all the usual sympathetic disturbances of pregnancy exist: the breasts enlarge, the areolæ darken, and morning sickness is present. There is also an arrest of menstruation; but, after the absence of one or more periods, there is often an irregular hemorrhagic discharge. This is an important symptom, the value of which in indicating the existence of tubal pregnancy has of late years been much dwelt upon by various authors, both in this country and abroad. Barnes attributes it to partial detachment of the chorion villi, produced by the ovum growing out of proportion to the tube in which it is contained. Whether this is the correct explanation or not, it is a fact that irregular hemorrhage very generally precedes the laceration for several days or more. Accompanying this hemorrhage there is almost always more or less abdominal pain, produced by the stretching of the tissues in which the ovum is placed, and this is sometimes described as being of a very intense and crampy character. If, then, we meet with a case in which the symptoms of early pregnancy exist, in which there are irregular losses of blood, possibly discharge of membraneous shreds, and abdominal pain, a careful examination should be insisted on, and then the true nature of the case may possibly be ascertained. Should extra-uterine fœtation exist, we should expect to find the uterus somewhat enlarged, and the cervix softened, as in early pregnancy; but both these changes are doubtless generally less marked than in normal pregnancy. This fact of itself, however, is of little diagnostic value, for slight difference of this kind must always be too indefinite to justify a positive opinion.

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[1] Annales de Gynécologie [illegible] 874.

The existence of a peri-uterine tumor, rounded or oval in outline, and producing more or less displacement of the uterus, in the direction opposite to that in which the tumor is situated, may, however, point to the existence of tubular fœtation. By bi-manual examination, one hand depressing the abdominal wall, while the examining finger of the other acts in concert with it either through the vagina or rectum, the size and relations of the growth may be made out. There are various conditions, however, which give rise to very similar physical signs, such as small ovarian or fibroid growths, or the effusion of blood around the uterus; and the differential diagnosis must always be very difficult, and often impossible. A curious example of the difficulties of diagnosis is recorded by Joulin, in which Huguier, and six or seven of the most skilled obstetricians of Paris, agreed on the existence of extra-uterine pregnancy, and had, in consultation, sanctioned an operation, when the case terminated by abortion and proved to be a natural pregnancy. The use of the uterine sound, which might aid in clearing up the case, is necessarily contra-indicated unless uterine gestation is positively disproved. Hence it must be admitted that positive diagnosis must almost always be very difficult. So that the most we can say is, that when the general signs of early pregnancy are present, associated with the other symptoms and signs alluded to, the suspicion of tubal pregnancy may be sufficiently strong to justify us in taking such action as may possibly spare the patient the necessarily fatal consequence of rupture. If the diagnosis was quite certain, the removal of the entire Fallopian tube and its contents by abdominal section would be quite justifiable, and probably would neither be more difficult nor more dangerous than ovariotomy; for at this stage of extra-uterine fœtation there are no adhesions to complicate the operation. As yet, however, the uncertainty of the diagnosis has prevented the adoption of the practice.

Within the last few months Dr. Thomas, of New York,[1] has recorded a most instructive case, in which he saved the life of the patient by a bold and judicious operation. The nature of the case was rendered pretty evident by the signs above described, and Thomas opened the cyst from the vagina by a platinum knife rendered incandescent by a galvano-caustic battery, by which means he hoped to prevent hemorrhage. Through the opening thus made he removed the fœtus. In subsequently attempting to remove the placenta, very violent hemorrhage took place, which was only arrested by injecting the cyst with a solution of persulphate of iron. The remains of the placenta subsequently came away piecemeal, after an attack of septicæmia, which was kept within bounds by freely washing out the cyst with antiseptic lotion, the patient eventually recovering. If I might venture to make a criticism on a case followed by so brilliant a success, it would be that in another instance of this kind it would be safer to follow the rule so strictly laid down with regard to gastrotomy in abdominal pregnancies, and leave the placenta untouched, trusting to the injection of antiseptics, and the thorough drainage of the cyst, to prevent mischief.

Another mode of managing these cases is to destroy the fœtus, so as to check its further growth, in the hope that it may remain inert and passive within its sac. Various operations have been suggested and practised for this purpose. Thus, needles have been introduced into the tumor, through which currents of electricity have been passed, either the continuous current, or, as has been suggested by Duchenne, a spark of Franklinic electricity. In a case reported by Dr. Bachetti, in which the continuous current was used, the growth of the ovum was arrested, and the patient recovered. The same result, however, would probably have followed the simple puncture of the cyst. This has been successfully practised on several occasions, either with a small trocar and canula, or with a simple needle. A very interesting case, in which the development of a two months' tubal gestation was arrested in this way, is recorded by Greenhalgh,[2] and another by Martin, of Berlin.[3] Joulin suggested that not only should the cyst be punctured, but that a solution of morphia should be injected into it, which, by its toxic influence, would ensure the destruction of the fœtus. Other means proposed for effecting the same object, such as pressure, or the administration of toxic remedies by the mouth, are far too uncertain to be relied on. The simplest and most effectual plan would be to introduce the needle of an aspirator, by which the liquor amnii would be drawn off, and the further growth of the fœtus effectually prevented. It may be laid down, then, as a rule, that this should at once be done by the roof of the vagina in every case in which the presence of a peri-uterine tumor, associated with the usual signs of pregnancy, and irregular metrorrhagia and pain, gives rise to the suspicion of extra-uterine pregnancy. In all cases the patient should have the benefit of the doubt; and, even if we are wrong in our suspicions, no harm is likely to follow, for the mere passage of the fine tube of the aspirator is not likely to produce any serious mischief, even when some other growth has been mistaken for a tubular fœtation. If the aspirator proves that an extra-uterine fœtation exists, then, if the cyst is of any considerable size, and the pregnancy advanced beyond the second month, we might, if deemed advisable, resort to a more radical operation, such as that so successfully practised by Thomas.

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[1] New York Med. Jour., June, 1875.

[2] Lancet, 1867.

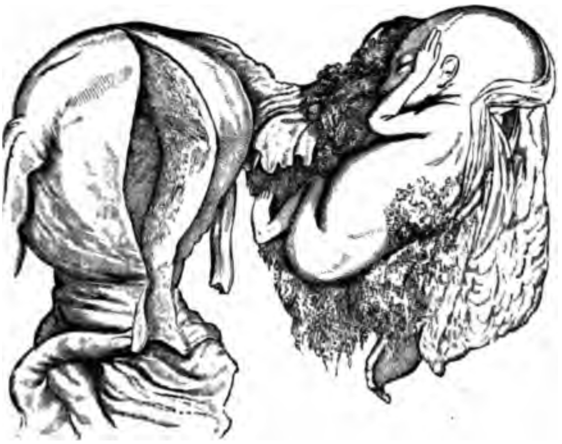
[3] Monat. f. Geburt, 1868.

Treatment when Rupture has occurred.—When, however, the chance of arresting the growth of a tubular fœtation has never arisen, and we first recognize its existence after laceration has occurred, and the patient is collapsed from hemorrhage, what course are we to pursue? Hitherto all that ever has been done is to attempt to rally the patient by stimulants, and, in the unlikely event of her surviving the immediate effects of laceration, endeavoring to control the subsequent peritonitis, in the hope that the effused blood may become absorbed, as in pelvic hematocele. This is, indeed, a frail reed to rest upon, and when laceration of a tubal gestation, advanced beyond a month, has occurred, death has been the almost certain result. It is supposed by Bernutz, and his opinion is shared by Barnes, that rupture which does not prove fatal is probably not very rare in the first few days of extra-uterine gestation, and that it is not an uncommon cause of certain forms of pelvic hematocele. It has more than once been suggested that it would be perfectly justifiable when laceration has occurred to perform gastrotomy, to sponge away the effused blood, and to place a ligature round the lacerated tube and remove it, with its contents. This would no doubt be a bold and heroic procedure, but no one who is acquainted with the triumphs of modern abdominal surgery can say that it would be either impossible or hopeless. The sponging out of effused blood from the abdominal cavity is an every-day procedure in ovariotomy, nor is there any apparent difficulty in ligaturing and removing the sac of the extra-uterine pregnancy, for, as a rule, there are no adhesions formed to the surrounding parts. The history of these cases shows that death does not generally follow rupture for some hours, so that there would be usually time for the operation, and the extreme prostration might be, perhaps, temporarily counteracted by transfusion. Pressure on the abdominal aorta, resorted to when the patient is first seen, might possibly be employed with advantage to check further hemorrhage, until the question of operation is decided. We must remember that the alternative is death, and hence any operation which would afford the slightest hope of success would be perfectly justifiable. I cannot, therefore, agree with those who hold that because the chances of success are so small, the operation should not be tried; and I do not doubt that it will yet fall to the lot of some one, by this means, to snatch a patient from the jaws of death, and still further to extend the successes of abdominal surgery.

Abdominal Pregnancy.—In the second of the two classes into which, for practical convenience, we have divided extra-uterine gestation, the ovum is developed in the abdominal cavity itself. It is as yet an open question whether in some cases the pregnancy is primarily abdominal or not. Barnes believes that it probably never is so, on account of the difficulty of admitting that so minute a body as the ovum should be able to fix itself on the smooth peritoneal surface. He therefore thinks that all abdominal pregnancies are primarily either tubal or ovarian, the sac in which they were contained having given way, and the ovum having retained its vitality through partial attachment to the original sac. This theory is opposed to that of the majority of writers, and, although it may perhaps render the facts less difficult to understand, it is purely hypothetical. There is no evidence to show that in most cases there is an early laceration of a tubal or ovarian sac. That the chorion villi do graft themselves upon the surrounding peritoneum is certain, and is observed in all cases of abdominal gestation. It is not more difficult to imagine them doing this from their very first development than a little later; for it must be allowed that if such laceration does occur, in most cases it can only be when pregnancy is very slightly advanced. On the whole, therefore, it seems not unreasonable to admit the usual explanation of these cases, that the ovule, already impregnated, escaped the grasp of the Fallopian tube, and fell into the abdominal cavity, where it rooted itself and developed. Some have, indeed, supposed that abdominal pregnancy may occasionally arise in consequence of spermatozoa finding their way into the peritoneal cavity and there meeting and impregnating an ovule discharged from the Graafian follicle. Such an event one would suppose to be almost impossible, but Koeberlé's case, already quoted, proves that it has actually occurred. The probability is that it is by no means rare for impregnated ovules to drop into the peritoneal cavity, and that the majority of those that do so perish without doing any harm. When they do survive, however, the chorion villi sprout, attach themselves to the surrounding structures, and eventually develop into a placenta. The mode in which the chorion villi are attached, and the arrangement of the maternal blood-vessels, have never yet been worked out, and would form a very interesting subject for investigation. The precise seat of attachment varies, and the placenta has been found fixed to most of the abdominal viscera, either those contained in the pelvis proper, or it may be the intestines, or to the iliac fossa; most frequently, apparently, the ovum finds its way into the retro-uterine cul-de-sac.

The subsequent changes vary much. In the large majority of cases the ovum produces considerable irritation, resulting in the exudation of plastic material, which is thrown round it, so as to form a secondary cyst or capsule, in which maternal vessels are largely developed, and which stretches, *pari passu*, with the growth of the ovum (Fig. 75). The density and strength of this cyst are found to be very different in different cases; sometimes it forms a complete and strong covering to the ovum, at others it is very thin and only partially developed, but it is rarely entirely absent. As there is ample space for the development of the ovum, and as the secondary cyst generally stretches and grows along with it, most cases of abdominal pregnancy progress without any very remarkable symptoms, beyond occasional severe attacks of pain, until the full term of pregnancy has been reached. Sometimes, however, the cyst lacerates, and there is an escape of blood into the abdominal cavity, accompanied by more or less prostration and collapse, which may prove fatal, but from which the patient more generally rallies. The fœtus, now dead, will remain in the abdomen, and will undergo changes and produce results similar to those which we shall presently describe as occurring in cases progressing to the full period.

FIG. 75.

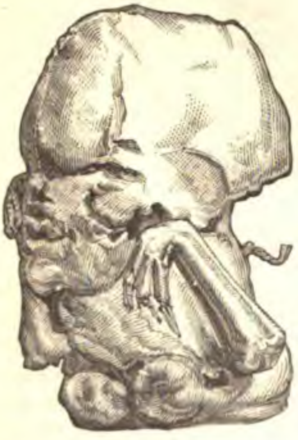


UTERUS AND FŒTUS IN A CASE OF ABDOMINAL PREGNANCY.

In most cases at the natural termination of pregnancy a strange series of phenomena occur; pseudo-labor comes on; there are more or less frequent and strong uterine contractions, possibly an escape of blood from the vagina, the discharge of the broken-down uterine decidua, and even the establishment of lactation. Sometimes the contractions of the abdominal muscles, produced by this ineffective labor, have been so strong as to cause the laceration of the adventitious cyst surrounding the fœtus, and the escape of blood and liquor amnii into the abdominal cavity, with a rapidly fatal result. More frequently laceration does not occur, and the spurious labor pains continue at intervals, until the fœtus dies, possibly from pressure, but more often from effusion of blood into the tissue of the placenta, and consequent asphyxia. Occasionally the fœtus has apparently lived a considerable time, in some cases even for several months, after the natural limit of pregnancy has been reached.

It is after the death of the fœtus that the dangers of abdominal pregnancy generally commence; and they are numerous and various. The subsequent changes that occur are well worthy of study. Occasionally the fœtus has been retained for a length of time, even until the end of a long life, without producing any serious discomfort, and in many cases of this kind several normal pregnancies and deliveries have subsequently taken place. Even when the extra-uterine gestation appears to be tolerated, and has remained for long without producing any bad effects, serious symptoms may be suddenly developed; so that no woman, under such circumstances, can be considered safe. The condition of these retained fœtuses varies much. Most commonly the liquor amnii is absorbed, the fœtus shrinks and dies, all its soft structures are changed into adipocere, and the bones only remain unaltered. Sometimes this change occurs with great rapidity. I have elsewhere[1] recorded a case of extra-uterine fœtation in which at the full term of pregnancy the fœtus was alive, and the woman died in less than a year afterwards. On post-mortem the fœtus was found entirely transformed into a greasy mass of adipocere, studded with fœtal bones, in which not a trace of any of the soft parts could be detected. On the other hand, the fœtus may remain unchanged; in the Museum of the College of Surgeons there is one which was retained in the abdomen for fifty-two years, and which was found to be as fresh and unaltered as a new-born child. In other cases the sac and its contents atrophy and shrink, and calcareous matter is deposited in them, so that the whole becomes converted into a solid mass known as a *lithopædion* (Fig. 76). The cases, however, in which the retention of the fœtus remains innocuous are quite exceptional. Generally the fœtus putrefies, and this may either immediately give rise to fatal peritonitis or septicæmia, or, as more commonly happens, to secondary inflammation and suppuration of the sac. Under the influence of the latter the sac opens externally, either directly at some point of the abdominal walls, or indirectly through the vagina, the bowels, or even the bladder. Through the aperture or apertures thus formed (for there are often several fistulous openings), pus, and the bones and other parts of the broken-down fœtus, are discharged; and this may go on for months, and even years, until at last, if the patient's strength does not give way, the whole contents of the cyst are expelled, and recovery takes place. From various statistical observations it appears that the chances of recovery are best when the cyst opens through the abdominal walls, next through the vagina or bladder, and that the fœtus is discharged with most difficulty and danger when the aperture is formed into the bowel. At the best, however, the process is long, tedious, and full of dangers, and the patient too often sinks, during the attempt at expulsion, through the irritation and exhaustion produced by the abundant and long-continued discharge.

FIG. 76.



LITHOPÆDION.
(From a preparation in the Museum of the College of Surgeons.)

The *diagnosis* of abdominal gestation is by no means so easy as might be thought, and the most experienced practitioners have been mistaken with regard to it.

The most characteristic symptom, although this is not so common as in tubal gestation, is metrorrhagia, combined with the general signs of pregnancy. Very severe and frequently repeated attacks of abdominal pain are rarely absent, and should at once cause suspicion, especially if associated with hemorrhage. They seem to depend on intercurrent attacks of peritonitis, by which the fœtal cyst is formed. On abdominal palpation the form of the abdomen will be observed to differ from that of normal pregnancy, being generally more developed in the transverse direction, and the rounded outline of the gravid uterus cannot be detected. When development has advanced nearly to term, the extreme distinctness with which the fœtal limbs can be felt will arouse suspicion. Per vaginam the os and cervix will be felt softened as in ordinary pregnancy, but often displaced by the pressure of the cyst, and sometimes fixed by peri-metritic adhesions; either of these signs is of great diagnostic value.

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[1] Obstet. Trans., vol. vii.

By bi-manual examination it may be possible to make out that the uterus is not greatly enlarged, and that it is distinctly separate from the bulk of the tumor; these facts, if recognized, would of themselves disprove the existence of uterine gestation. The diagnosis would be cleared up in any case by the uterine sound, which would show that the uterus was empty and only slightly elongated, while the fœtal limbs or heart-sounds could be detected. But we must be careful not to resort to this test unless the existence of uterine gestation is positively disproved by other means. As, however, it places the diagnosis beyond a doubt, it should always be employed whenever operative procedure is in contemplation.

The *treatment* of abdominal gestation will always be a subject of anxious consideration, and there is much difference of opinion among authorities as to the proper course to pursue. It is pretty generally admitted that it is not advisable to adopt any active measures until the full term of development is reached. Puncturing the cyst, with the view of destroying the fœtus and arresting its further growth, has been practised, but there are good grounds for rejecting it, for there is not the same imminent risk of death from rupture of the cyst as in tubal fœtation; and, even if the destruction of the fœtus could be brought about, there would still be formidable dangers from subsequent attempts at elimination, or from internal hemorrhage.

When the full period has arrived, the child being still alive, as proved by auscultation, we have to consider whether it may not be advisable to perform gastrotomy before the fœtus perishes, and so at least save the life of the child. There are few questions of greater importance and more difficult to settle. The tendency of medical opinion is rather in favor of immediate operation, which is recommended by Velpeau, Kiwisch, Koeberlé, Schroeder, and many other writers, whose opinion necessarily carries great weight. The arguments in favor of immediate operation are that, while it affords almost a certainty of saving the child, the risks to the mother, great though they undoubtedly are, are not greater than those which may be anticipated by delay. If we put off interference, the cyst may rupture during the ineffectual efforts at labor, and death at once ensue; or, if this does not take place, other risks, which can never be foreseen, are always in store for the patient.

She may sink from peritonitis, or from exhaustion, consequent on the efforts at elimination which in the majority of cases are sooner or later set up, so that, as Barnes properly says, "the patient's life may be said to be at the mercy of accidents of which we have no sufficient warning." On the other hand, if we delay, while we sacrifice all hope of saving the child, we at least give the mother the chance of the fœtation remaining quiescent for a length of time, as certainly not unfrequently occurs. Thus, Campbell collected sixty-two cases of ultimate recovery after abdominal gestation, in twenty-one of which the fœtus was retained without injury for a number of years. Then there is the question of secondary gastrotomy, which consists in operating after the death of the fœtus when urgent symptoms have arisen, a course which is advocated by Mr. Hutchinson. In favor of this procedure it is urged that by delay the inflammation taking place about the cyst will have greatly increased the chance of adhesions having formed between it and the abdominal parietes, so as to shut off its contents from the cavity of the peritoneum. The more effectually this has been accomplished, the greater are the patient's chances of recovery. When the fœtus has been dead for some time, the vascularity of the cyst will also be lessened, and the placental circulation will have ceased, so that the danger of hemorrhage will be much diminished.

It will be seen, therefore, that there are arguments in favor of each of these views, which render it impossible to give a decided preference to any one of them. Much must depend on the state of the patient. If her sufferings are very great, and her general condition favorable, the primary operation would probably be the best course to pursue. In such a case, after laying before the patient and her friends the arguments on either side, the practitioner might fairly be guided, to some extent, by their wishes. It is only just to remember, as is forcibly pointed out by Keller, that in these days of advanced abdominal surgery a better result might be anticipated than when gastrotomy was performed in the haphazard way which was usual before we had gained experience from ovariotomy. No doubt minute care in the performance of the operation, a due attention to its details, studiously avoiding, as much as possible, the passage of blood and the contents of the cyst into the peritoneal cavity, would materially lessen its peril.

The *operation*, then, should be performed with all the precautions with which we surround ovariotomy. The incision, best made in the linea alba, should not be greater than is necessary to extract the fœtus, and may be lengthened as occasion requires. If there are no adhesions, the walls of the cyst should be stretched to the margin of the incision, so as to shut it off as completely as possible from the peritoneal cavity. This has been specially insisted on by Dr. Braxton Hicks, and should never be omitted. Another cardinal rule, both in primary and secondary gastrotomy, is to make no attempt to remove the placenta. Its attachments are generally so deep-seated and diffused that any endeavor to separate it is likely to be attended with profuse and uncontrollable hemorrhage, or with serious injury to the structures to which it is attached. Many of the failures after operating can be traced to a neglect of this rule. The best subsequent course to pursue, after removing the fœtus, and arresting all hemorrhage, either by ligature or the actual cautery, is to sponge out the cyst as gently as possible, and then to bring the upper part of the wound into apposition with sutures, leaving the lower open, with the cord protruding, so as to ensure an outlet for the escape of the placenta as it breaks down. The subsequent treatment must be specially directed to favor the escape of the discharge and to prevent the risk of septicæmia. These objects may be much aided by injections of antiseptic fluids, such as a solution of carbolic acid, or diluted Condy's fluid; and it would perhaps be advisable to place a drainage-tube in the lower angle of the wound.

As long as the placenta is retained, the danger is necessarily great, and it may be many days or even weeks before it is discharged. When once this is effected, the sac may be expected to contract, and eventually to close entirely.

Treatment.—When the fœtus is dead, or when we have determined not to attempt primary gastrotomy, it is advisable to wait, very carefully watching the patient, until either the gravity of her general symptoms, or some positive indication of the channel through which nature is about to attempt to eliminate the fœtus, shows us that the time for action has arrived. If there is distinct bulging of the cyst in the vagina, or in the retro-vaginal cul-de-sac, especially if an opening has formed there, we may properly content ourselves with aiding the passage of the fœtus through the channel thus indicated, and removing the parts that present piecemeal as they come within reach, cautiously enlarging the aperture if necessary. If the sac has opened into the intestines, the expulsion of the fœtus through this channel is so tedious and difficult, the exhaustion attending it so likely to prove fatal, and the danger from decomposition of the fœtus through passage of intestinal gas so great, that it would probably be best to attempt to remove it by gastrotomy, especially if it is only recently dead and the greater portion is still retained.

Secondary Gastrotomy.—If an opening forms at the abdominal parietes, or if the symptoms determine us to resort to secondary gastrotomy before this occurs, the operation must be performed in the same way, and with the same precautions, as primary gastrotomy. Here, as before, the safety of the operation must greatly depend on the amount and firmness of the adhesions; for if the cyst be not completely shut off from the peritoneal cavity, the risks of the operation will be little less than those of primary gastrotomy. It would obviously materially influence our decision and prognosis if we could determine this point before operating. Unfortunately, it is impossible, as the experience of ovariotomists proves, to ascertain the existence of adhesions with any certainty. If, however, we find that the abdominal parietes do not move freely over the cyst, and if the umbilicus be depressed and immovable, the presumption is that considerable adhesions exist. If they are found not to be present, the cyst walls should be stretched to the margin of the incision, in the manner already indicated, before the contents are removed.

If the fœtus has been long dead, and its tissues greatly altered, its removal may be a matter of difficulty. In the case under my own care, already alluded to, the fœtal structures formed a sticky mass of such a nature that I believe it would have been impossible to empty the cyst had an operation been attempted. This possibility would be, to some extent, a further argument in favor of the primary operation.

Opening of Cyst by Caustics.—The importance of adhesion has led some practitioners to recommend the opening of the cyst by potassa fusa or some other caustic, in the hope that it would set up adhesive inflammation around the apertures thus formed. Several successful operations by this method are recorded, and it would be worth trying, should the extreme mobility of the cyst lead us to suspect that no adhesions existed. If we have to deal with a case in which fistulous openings leading to the cyst have already formed, it may, perhaps, be advisable to dilate the apertures already existing, rather than make a fresh incision; but in determining this point the surgeon will naturally be guided by the nature of the case, and the character and direction of the fistulous openings.

General Treatment.—It is almost needless to say anything of general treatment in these trying cases; but the administration of opiates to allay the sufferings of the patient, and the endeavor to support the severely taxed vital energies by appropriate food and medication, will form a most important part of the management.

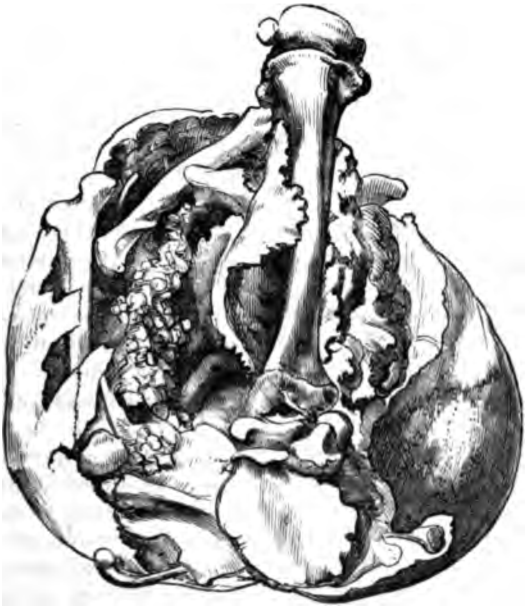
Gestation in a Bi-lobed Uterus.—A few words may be said as to gestation in the rudimentary horn of a bi-lobed uterus, to which considerable attention has of late years been directed by the writings of Kussmaul and others. It appears certain that many cases of supposed tubal gestation are really to be referred to this category. Although such cases are of interest pathologically, they scarcely require much discussion from a practical point of view, inasmuch as their history is pretty nearly identical with that of tubal pregnancy. The rudimentary horn is distended by the enlarging ovum, and after a time, when further distension is impossible, laceration takes place. As a matter of fact, all the thirteen cases collected by Kussmaul terminated in this way; and even on post-mortem examination it is often extremely difficult to distinguish them from tubal pregnancies. The best way of doing so is probably by observing the relations of the round ligaments to the tumor; for, if the gestation be tubal, they will be found attached to the uterus on the inner or uterine side of the cyst; whereas, if the pregnancy be in a rudimentary horn of the uterus, they will be pushed outwards and be external to the sac. In the latter case, moreover, the sac will be probably found to contain a true decidua, which is not the case in tubal pregnancy. The only point in which they differ is that in cornual pregnancy rupture may be delayed to a somewhat later period than in tubal, on account of the greater distensibility of the supplementary horn.

The term "*missed labor*" is applied to an exceedingly rare class of cases, in which, at the full period of pregnancy, labor has either not come on at all, or, having commenced, the pains have subsequently passed off, and the fœtus is retained in utero for a very considerable length of time. Under such circumstances it has usually happened that the membranes have ruptured at or about the proper term, and the access of air to the fœtus in utero has been followed by decomposition. A putrid and offensive discharge has then commenced, and eventually portions of the disintegrating fœtus have been expelled per vaginam. This discharge may go on until the entire fœtus is gradually thrown off; or, more frequently, the patient dies from septicæmia, or other secondary result of the presence of the decomposing mass in utero.

Thus, McClintock relates one case,[1] in which symptoms of labor came on in a woman, 45 years of age, at the expected period of delivery, but passed off without the expulsion of the fœtus. For a period of sixty-seven weeks a highly offensive discharge came away, with some few bones, and she eventually died with symptoms of pyæmia. He also cites another case in which the patient died in the same way, after the fœtus had been retained for eleven years.

Sometimes, when the fœtus has been retained for a length of time, a further source of danger has been added by ulceration or destruction of the uterine walls, probably in consequence of an ineffectual attempt at its elimination. This occurred in Dr. Oldham's case (Fig. 77), in which the contained mass is said to have nearly worn through the anterior walls of the uterus; and also in one reported by Sir James Simpson,[2] in which a patient died three months after term, the fœtus having undergone fatty metamorphosis, an opening the size of half a crown

FIG. 77.



CONTENTS OF THE CYST IN DR. OLDHAM'S CASE OF MISSED LABOR.

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[1] Dublin Quart. Journ., Feb. and May, 1864.
Edin. Med. Journ., 1865.

having formed between the transverse colon and the uterine cavity. It is also stated that "the uterine walls were as thin as parchment."

In some few cases, however, probably when the entrance of air has been prevented, the fœtus has been retained for a length of time without decomposing, and without giving rise to any troublesome symptoms. Such a case is reported by Dr. Cheston,[1] in which the fœtus remained in utero for fifty-two years.

The causes of this strange occurrence are altogether unknown. Generally the fœtus seems to have died some time before the proper term for labor, and this may have influenced the character of the pains. It is probably also most apt to occur in women of feeble and inert habit of body, possibly where there was some obstacle to the dilatation of the cervix, which the pains were unable to overcome. Barnes suggests[2] that some presumed examples of missed labor "were really cases of interstitial gestation, or gestation in one horn of a two-horned uterus." In several of the cases, however, the details of the post-mortem examination are too minute to admit of the possibility of this mistake having been made.

From what has been said, it will be seen that the dangers arising from this state are very considerable, and when once the full term has passed beyond doubt, especially if the presence of an offensive discharge shows that decomposition of the fœtus has commenced, it would be proper practice to empty the uterus as soon as possible. The necessary precaution, however, is not to decide too quickly that the term has really passed; and, therefore, we must either allow sufficient time to elapse to make it quite certain that the case really falls under this category, or have unequivocal signs of the death of the fœtus, and injury to the mother's health. If we had to deal with the case before any extensive decomposition of the fœtus had occurred, we probably should find little difficulty in its management, for the proper course then would be to dilate the cervix with the fluid dilators, and remove the fœtus by turning; or, before doing so, we might endeavor to excite uterine action by pressure and ergot, in hope that pains might be induced. If, however, the case did not come under observation until disintegration of the fœtus had begun, it would be more difficult to deal with. If the fœtus had become so much broken up that it was being discharged in pieces, Dr. McClintock says[3] that "in regard to treatment, our measures should consist mainly of palliatives, viz., rest and hip-baths to subdue uterine irritation; vaginal injections to secure cleanliness and prevent excoriation; occasional digital examination, so as to detect any fragments of bone that might be presenting at the os, and to assist in removing them. These are plain rational measures, and beyond them we shall scarcely, perhaps, be justified in venturing. Nevertheless, under certain circumstances, I would not hesitate to dilate the cervical canal so as to permit of examining the interior of the womb, and of extracting any fragments of bone that may be easily accessible; but unless they could thus be easily reached and removed, the safer course would be to defer, for the present, interfering with them."

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[1] Med.-Chir. Trans., 1814.

[2] Diseases of Women, p. 445.

[3] Dublin Quarterly Journ., vol. xxxvii. p. 314.

It may be doubted, I think, whether, considering the serious results which are known to have followed so many cases, it would not, on the whole, be safer to make at least one decided effort, under chloroform, to remove as much as possible of the putrefying uterine contents, after the os has been fully dilated. Such a procedure would be less irritating than frequently repeated endeavors to pick away detached portions of the fœtus as they present at the os uteri. When once the os is dilated, antiseptic intra-uterine injections, as of diluted Condy's fluid, might safely and advantageously be used. Unquestionably, it would be better practice to interfere and empty the uterus as soon as we are quite satisfied of the nature of the case, rather than to delay until the fœtus has been disintegrated.

CHAPTER VII.

DISEASES OF PREGNANCY.

THE diseases of pregnancy form a subject so extensive that they might well of themselves furnish ample material for a separate treatise. The pregnant woman is, of course, liable to the same diseases as the non-pregnant; but it is only necessary to allude to those whose course and effects are essentially modified by the existence of pregnancy, or which have some peculiar effect on the patient in consequence of her condition. There are, moreover, many disorders which can be distinctly traced to the existence of pregnancy. Some of them are the direct results of the sympathetic irritations which are then so commonly observed; and, of these, several are only exaggerations of irritations which may be said to be normal accompaniments of gestation. These functional derangements may be classed under the head of neuroses, and they are sometimes so slight as merely to cause temporary inconvenience, at others so grave as seriously to imperil the life of the patient. Another class of disorders are to be traced to local causes in connection with the gravid uterus, and are either the mechanical results of pressure, or of some displacement or morbid state of the uterus; while the origin of others may be said to be complex, being partly due to sympathetic irritation, partly to pressure, and partly to obscure nutritive changes produced by the pregnant state.

Derangements of the Digestive System.—Among the sympathetic derangements there are none which are more common, and none which more frequently produce distress, and even danger, than those which affect the digestive system. Under the heading of "The Signs of Pregnancy," the frequent occurrence of nausea and vomiting has already been discussed, and its most probable causes considered (p. 129). A certain amount of nausea is, indeed, so common an accompaniment of pregnancy, that its consideration as one of the normal symptoms of that state is fully justified. We need here only discuss those cases in which the nausea is excessive and long-continued, and leads to serious results from inanition and from the constant distress it occasions. Fortunately, a pregnant woman may bear a surprising amount of nausea and sickness without constitutional injury, so that apparently almost all aliments may be rejected, without the nutrition of the body very materially suffering. At times the vomiting is limited to the early part of the day, when all food is rejected, and when there is a frequent retching of glairy transparent fluid, in severe cases mixed with bile, while at the latter part of the day the stomach may be able to retain a sufficient quantity of food, and the sense of nausea disappears. In other cases, however, the nausea and vomiting are almost incessant; the patient feels constantly sick, and the mere taste or sight of food may bring on excessive and painful vomiting. The duration of this distressing accompaniment of pregnancy is also variable. Generally it commences about the third month, and disappears after the woman has quickened. Sometimes, however, it begins with conception, and continues unabated until the pregnancy is over.

In the worst class of cases, when all nourishment is rejected, and when the retching is continuous and painful, symptoms of very great gravity, which may even prove fatal, develop themselves. The countenance becomes haggard from suffering, the tongue dry and coated, the epigastrium tender on pressure, and a state of extreme nervous irritability, attended with restlessness and loss of sleep, becomes established. In a still more aggravated degree, there is general feverishness, with a rapid, small, and thready pulse. Extreme emaciation supervenes, the result of wasting from lack of nourishment. The breath is intensely fetid, and the tongue dry and black. The vomited matters are sometimes mixed with blood. The patient becomes profoundly exhausted, a low form of delirium ensues, and death may follow if relief is not obtained. .

Prognosis.—Symptoms of such gravity are fortunately of extreme rarity, but they do from time to time arise, and cause much anxiety. Gueniot collected 118 cases of this form of the disease, out of which 46 died, and out of the 72 that recovered, in 42 the symptoms only ceased when abortion, either spontaneous or artificially produced, had occurred. When pregnancy is over, the symptoms occasionally cease with marvellous rapidity. The power of retaining and assimilating food is rapidly regained, and all the threatening symptoms disappear.

Treatment.—In the milder forms of obstinate vomiting, one of the first indications will be to remedy any morbid state of the primæ viæ. The bowels will not unfrequently be found to be obstinately constipated, the tongue loaded, and the breath offensive; and when attention has been paid to the general state of the digestive organs by gentle aperient medicines, and antacid remedies, such as bismuth and soda, and pepsine after meals, the tendency to vomiting may abate without further treatment.

Regulation of Diet.—The careful regulation of the diet will be one of the first indications. Great benefit is often derived from recommending the patient not to rise from the recumbent position in the morning until she has taken something. Half a cup of milk and lime-water, or a cup of strong coffee, or a little rum and milk, or cocoa and milk, or even a morsel of biscuit taken on waking, often has a remarkable effect in diminishing the tendency to nausea. When any attempt at swallowing solid food brings on vomiting, it is better to give up all pretence at keeping to regular meals, and to order such light and easily assimilated food, at short intervals, as can be retained. Iced milk with lime- or soda-water, given frequently, and not more than a mouthful at a time, will frequently be retained when nothing else will. Cold beef jelly, a spoonful at a time, will also be often kept down. It is well, however, to bear in mind, in regulating the diet, that the stomach is fanciful and capricious, and that the patient may be able to retain strange and apparently unlikely articles of food; and that, if she expresses a desire for such, the experiment of letting her have them should certainly be tried.

Medicinal Treatment.—The medicines that have been recommended in the obstinate vomiting of pregnancy are innumerable, and the practitioner will often have to try one after the other unsuccessfully; or may find, in an individual case, that a remedy will prove valuable which, in another, may be altogether powerless. Amongst those most generally useful are effervescing draughts, containing from three to five minims of dilute hydrocyanic acid; the creosote mixture of the Pharmacopœia; tincture of nux vomica, in doses of five to ten minims; salicine, in doses of three to five grains three times a day, recommended by Tyler Smith; oxalate of cerium, in the form of pill, of which three to five grains may be given three times a day—a remedy strongly advocated by Sir James Simpson, and which occasionally is of undoubted service, but more often fails; the compound pyroxylic spirit of the London Pharmacopœia in doses of five minims every four hours, with a little compound tincture of cardamoms, a drug which is comparatively little known, but which occasionally has a very marked and beneficial effect in checking vomiting; opiates in various forms—which sometimes prove useful, more often not—may be administered either by the mouth or in pills containing from half a grain to a grain of opium, or in small doses of the solution of the bi-meconate of morphia or of Battley's sedative solution, or subcutaneously, a mode of administration which is much more often successful. If there is much tenderness about the epigastrium, one or two leeches may be advantageously applied, or one-third of a grain of morphia may be sprinkled on the surface of a small blister, or cloths saturated in laudanum may be kept over the pit of the stomach. In one or two cases I have found that the application of a spinal ice-bag to the cervical vertebræ, in the manner recommended by Dr. Chapman, has checked the vomiting when all drugs have failed. The ice may be placed in one of Chapman's spinal ice-bags, and applied for ten minutes or a quarter of an hour, twice or three times a day. It invariably produces a comforting sensation of warmth, which is always agreeable to the patient. Ice may be given to suck, *ad libitum*, and is of itself very useful; while, if there is much exhaustion, small quantities of iced champagne may also be given from time to time.

Local Treatment.—Inasmuch as the vomiting unquestionably has its origin in the uterus, it is only natural that practitioners should endeavor to check it by remedies calculated to relieve the irritability of that organ. Thus, morphia in the form of pessaries per vaginam, or belladonna applied to the cervix, have been recommended, and, the former especially, are often of undoubted service. A pessary containing one-third to half a grain of morphia may be introduced night and morning, without interfering with other methods of treatment. Dr. Henry Bennett directs especial attention to the condition of the cervix, which, he says, is almost always congested and inflamed, and covered with granular erosions. This he recommends to be treated by the application of nitrate of silver through the speculum. Dr. Clay, of Manchester, corroborates this view, and strongly advocates, especially when vomiting continues in the latter months, that one or two leeches should be applied to the cervix. Exception may fairly be taken to both these methods of treatment as being somewhat hazardous, unless other means have been tried and failed. I have little doubt, however, that in many cases a state of uterine congestion is an important factor in keeping up the unduly irritable condition of the uterine fibres, and an endeavor should always be made to lessen it by insisting on absolute rest in the recumbent posture. Of the importance of this precaution in obstinate cases there can be no question. Dr. Hewitt's views as to the dependence of sickness on flexions of the uterus have already been adverted to, and reasons have been given for doubting the general correctness of his theory. It is quite likely, however, that well-marked displacements of the uterus, either forwards or backwards, may serve to intensify the irritability of the organ. Cazeaux mentions an obstinate case immediately cured by replacing a retroverted uterus. A careful vaginal examination should, therefore, be instituted in all intractable cases, and if distinct displacement be detected, an endeavor should be made to support the uterus in its normal axis. If retroverted, a Hodge's pessary may be safely employed; if anteverted, a small air-ball pessary, as recommended by Hewitt, should be inserted. I believe, however, that such displacements are the exception rather than the rule in cases of severe sickness.

The importance of promoting nutrition by every means in our power should always be borne in mind. The exhaustion produced by want of food soon increases the irritable state of the nervous system, and, if the stomach will not retain anything, we can only combat it by occasional nutrient enemata of strong beef tea, yolk of egg, and the like.

Artificial Abortion.—Finally, in the worst class of cases, when all treatment has failed, and when the patient has fallen into the condition of extreme prostration already described, we may be driven to consider the necessity of producing artificial abortion. Fortunately, cases justifying this extreme resource are of great rarity; but nevertheless there is abundant evidence that, every now and then, women do die from uncontrollable vomiting, whose lives might have been saved had the pregnancy been brought to an end. The value of artificial abortion has been abundantly proved. Indeed, it is remarkable how rapidly the serious symptoms disappear when the uterus is emptied, and the tension of the uterine fibres lessened. It has, fortunately, only once fallen to my lot to have to perform this operation for intractable vomiting. In that case the patient was reduced to a state of the utmost prostration, having kept hardly any food on her stomach for many weeks, and when I first saw her she was lying in a state of low muttering delirium. Within a few hours after abortion was induced, all the threatening symptoms had disappeared, the vomiting had entirely ceased, and she was next day able to retain and absorb all that was given to her. The value of the operation, therefore, I believe to be undoubted. Where it has failed, it seems to have been on account of undue delay. Owing to the natural repugnance which all must feel towards this plan, it has generally been postponed until the patient has been too exhausted to rally. If, therefore, it is done at all, it should be before prostration has advanced so far as to render the operation useless. In these cases the obvious indication is to lessen the tension of the uterus at once, and therefore the membranes should be punctured by the uterine sound, so as to let the liquor amnii drain away, which will of itself be probably sufficient to accomplish the desired effect. It is almost needless to add that no one would be justified in resorting to this expedient without having his opinion fortified by consultation with a fellow-practitioner.

Other disorders of the digestive system may give rise to considerable discomfort, but not to the serious peril attending obstinate vomiting. Amongst them are loss of appetite, acidity, and heartburn, flatulent distension, and sometimes a capricious appetite which assumes the form of longing for strange and even disgusting articles of diet. Associated with these conditions there is generally derangement of the whole intestinal tract, indicated by furred tongue and sluggish bowels, and they are best treated by remedies calculated to restore a healthy condition of the digestive organs, such as a light easily-digested diet, mineral acids, vegetable bitters, occasional aperients, bismuth and soda, and pepsine. The indications for treatment are not different from those which accompany the same symptoms in the non-pregnant state.

Diarrhœa is an occasional accompaniment of pregnancy, often depending on errors of diet. When excessive and continuous, it has a decided tendency to induce uterine contractions, and I have frequently observed premature labor to follow a sharp attack of diarrhœa. It should, therefore, not be neglected; and, if at all excessive, should be checked by the usual means, such as chalk mixture with aromatic confection, and small doses of laudanum or chlorodyne. The possibility of apparent diarrhœa being associated with actual constipation, the fluid matter finding its way past the solid materials blocking up the intestines, should be borne in mind.

Constipation is much more common, and is indeed a very general accompaniment of pregnancy, even in women who do not suffer from it at other times. It partly depends, no doubt, on the mechanical interference of the gravid uterus with the proper movements of the intestines, and partly on defective innervation of the bowels resulting from the altered state of the blood. The first indication will be to remedy this defect by appropriate diet, such as fresh fruits, brown bread, oatmeal porridge, &c. Some medicinal treatment will also be necessary, and, in selecting the drugs to be used, care should be taken to choose such as are mild and unirritating in their action and tend to improve the tone of the muscular coats of the intestine. A small quantity of aperient mineral water in the early morning, especially the Friedrichshalle or Pullna water, often anwers very well; or an occasional dose of the confection of sulphur; or a pill containing three or four grains of the extract of colocynth, with a quarter of a grain of the extract of nux vomica, and a grain of extract of hyoscyamus at bedtime. The tendency to constipation is also sometimes effectually combated by administering, twice daily, a pill containing a couple of grains of the inspissated ox-gall, with a quarter of a grain of extract of belladonna, without ordering any direct aperient. Enemata of soap and water are often very useful, and have the advantage of not disturbing the digestion. In the latter months of pregnancy, especially in the few weeks preceding delivery, the irritation produced by the collection of hardened fæces in the bowel is a not unfrequent cause of the annoying false pains which then so commonly trouble the patient. In order to relieve them, it will be necessary to empty the bowels thoroughly by an aperient, such as a good dose of castor oil, to which fifteen or twenty minims of laudanum may be advantageously added. Should the rectum become loaded with scybalous masses, it may be necessary to break down and remove them by mechanical means, provided we are unable to effect this by copious enemata.

Hemorrhoids.—The loaded state of the rectum so common in pregnancy, combined with the mechanical effect of the pressure of the gravid uterus on the hemorrhoidal veins, often produces very troublesome symptoms from piles. In such cases a regular and gentle evacuation of the bowels should be secured daily, so as to lessen as much as possible the congestion of the veins. Any of the aperients already mentioned, especially the sulphur electuary, may be used. Dr. Fordyce Barker[1] insists that, contrary to the usual impression, one of the best remedies for this purpose is a pill containing a grain or a grain and a half of powdered aloes, with a quarter of a grain of extract of nux vomica, and that castor oil is distinctly prejudicial, and apt to increase the symptoms. I have certainly found it answer well in several cases. When the piles are tender and swollen, they should be freely covered with an ointment consisting of four grains of muriate of morphia to an ounce of simple ointment, or with the Ung. Gallæ c. Opio of the Pharmacopœia; and, if protruded, an attempt should be made to push them gently above the sphincter, by which they are often unduly constricted. Relief may also be obtained by frequent hot fomentations, and sometimes, when the piles are much swollen, it will be found useful to puncture them, so as to lessen the congestion, before any attempt at reduction is made.

Ptyalism.—A profuse discharge from the salivary glands is an occasional distressing accompaniment of pregnancy. It is generally confined to the early months, and is not excessive in amount. Occasionally, however, it continues during the whole period of gestation, and resists all treatment, only ceasing when delivery is over. Under such circumstances the discharge of saliva is sometimes enormous, amounting to several quarts a day, and the distress and annoyance to the patient are very great. In one case under my care the saliva poured from the mouth all day long, and for several months the patient sat with a basin constantly by her side, incessantly emptying her mouth, until she was reduced into a condition giving rise to really serious anxiety. This profuse salivation is, no doubt, a purely nervous disorder, and not readily under the influence of remedies. Astringent gargles, containing tannin and chlorate of potass, frequent sucking of ice, or of tannin lozenges, inhalation of turpentine and creosote, counter-irritation over the salivary glands by blisters or iodine, opium internally, may all be tried in turn, but none of them can be depended on with any degree of confidence.

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[1] The Puerperal Diseases, p. 88.

Severe dental neuralgia is also a frequent accompaniment of pregnancy, especially in the early months. When purely neuralgic, quinine in tolerably large doses is the best remedy at our disposal; but not unfrequently it depends on actual caries of the teeth, and attention should always be paid to the condition of the teeth when facial neuralgia exists. There is no doubt that pregnancy predisposes to caries, and the observation of this fact has given rise to the old proverb, "for every child a tooth." Mr. Oakley Coles, in an interesting paper[1] on the condition of the mouth and teeth during pregnancy, refers the prevalence of caries to the co-existence of acid dyspepsia, causing acidity of the oral secretions. There is much unreasonable dread amongst practitioners as to interfering with the teeth during pregnancy, and some recommend that all operations, even stopping, should be postponed until after delivery. It seems to me certain that the suffering of severe toothache is likely to give rise to far more severe irritation than the operation required for its relief, and I have frequently seen badly-decayed teeth extracted during pregnancy, and with only a beneficial result.

Affections of the Respiratory Organs.—Amongst the derangements of the respiratory organs produced by pregnancy, one of the most common is spasmodic cough, which is often excessively troublesome. Like many others of the sympathetic derangements accompanying gestation, this is purely nervous in character, and is unaccompanied by elevated temperature, quickened pulse, or any distinct auscultatory phenomena. In character it is generally spasmodic, and not unlike hooping-cough. The treatment must obviously be guided by the character of the cough. Expectorants are not likely to be of service; while benefit may be derived from some of the antispasmodic class of drugs, such as belladonna, hydrocyanic acid, opiates, or bromide of potassium. Such remedies may be tried in succession, but will often be found to be of little value in arresting the cough. Dyspnœa may also be nervous in character, and sometimes symptoms not unlike those of spasmodic asthma are produced. Like the other sympathetic disorders, this, as well as nervous cough, is most frequently observed during the early months. There is another form of dyspnœa, however, not uncommonly met with, which is the mechanical result of the interference with the action of the diaphragm and lungs by the pressure of the enlarged uterus. Hence this is most generally troublesome in the latter months, and continues unrelieved until delivery, or until the sinking of the uterine tumor which immediately precedes it. Beyond taking care that the pressure is not increased by tight lacing, or injudicious arrangement of the clothes, there is little that can be done to relieve this form of breathlessness.

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[1] Trans. of the Odontological Society.

Palpitation, like dyspnœa, may be due either to sympathetic disturbance, or to mechanical interference with the proper action of the heart. When occurring in weakly women, it may be referred to the functional derangements which accompany the chlorotic condition of the blood often associated with pregnancy, and is then best remedied by a general tonic regimen and the administration of ferruginous preparations. At other times antispasmodic remedies may be indicated; but it is seldom sufficiently serious to call for much special treatment.

Syncope.—Attacks of fainting are not rare, especially in delicate women of highly-developed nervous temperaments, and are perhaps most common at or about the period of quickening, although sometimes lasting through the whole pregnancy. In most cases these attacks cannot be classed as cardiac, but are more probably nervous in character, and they are rarely associated with complete abolition of consciousness. They rather, therefore, resemble the condition described by the older authors as *lypothemia*. The patient lies in a semi-unconscious condition, with a feeble pulse and widely-dilated pupils, and this state lasts for varying periods, from a few minutes to half an hour or more. In one very troublesome case under my care, they often recurred as frequently as three or four times a day. I have observed that they rarely occur when the more common sympathetic phenomena of pregnancy, especially vomiting, are present. Sometimes they terminate with the ordinary symptoms of hysteria, such as sobbing. The treatment should consist during the attack in the administration of diffusible stimulants, such as ether, sal-volatile, and valerian, the patient being placed in the recumbent position with the head low. If frequently repeated, it is unadvisable to attempt to rally the patient by the too free administration of stimulants. In the intervals a generally tonic regimen, and the administration of ferruginous remedies, are indicated. If they recur with great frequency, the daily application of the spinal ice-bag has proved of much service.

In connection with disorders of the circulatory system may be noticed those which depend on the state of the blood itself. The altered condition of the blood, which has already been described as a physiological accompaniment of pregnancy (p. 124), is sometimes carried to an extent which may fairly be called morbid; and, either on account of the deficiency of blood corpuscles, or of the increase in its watery constituents, a state of *extreme anæmia and chlorosis* may be developed. This may be sometimes carried to a very serious extent. Thus, Gusserow[1] records five cases, in which nothing but excessive anæmia could be detected, all of which ended fatally. Generally, when such anæmic symptoms have been carried to an extreme extent, the patient has been in a state of chlorosis before pregnancy. The treatment must, of course, be calculated to improve the general nutrition and enrich the impoverished blood; and a light and easily assimilated diet, milk, eggs, beef tea, and animal food if it can be taken, attention to the proper action of the bowels (generally very defective in this condition), a due amount of stimulants, and abundance of fresh air, will be the chief indications in the general management of the case. Medicinally, ferruginous preparations will be required. Some practitioners object, apparently without sufficient reason, to the administration of this class of remedies during pregnancy, as liable to promote abortion. This unfounded prejudice may probably be traced to the supposed emmenagogue properties of the preparations of iron; but, if the general condition of the patient indicates the necessity of such medication, they may be administered without any fear on this account. Preparations of phosphorus, such as the phosphide of zinc, or free phosphorus in capsules, also promise favorably, and are well worthy of trial.

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[1] Arch. f. Gyn., ii. 2, 1871.

Œdema associated with Hydræmia.—Some of the more aggravated cases are associated with a considerable amount of serous effusion into the cellular tissue, generally limited to the lower extremities, but occasionally extending to the arms, face, and neck, and even producing ascites and pleuritic effusion. Under the latter circumstances this complication is, of course, of great gravity, and it is said that after delivery the disappearance of the serous effusion may be accompanied by metastasis of a fatal character affecting the lungs or the nervous centres. This form of œdema must be distinguished from the slight œdematous swelling of the feet and legs so commonly observed as a mechanical result of the pressure of the gravid uterus, and also from those cases of œdema associated with albuminuria. The treatment must be directed to the cause, while the disappearance of the effusion may be promoted by the administration of diuretic drinks, the occasional use of saline aperients, and rest in the horizontal position.

Albuminuria.—The existence of albumen in the urine of pregnant women has for many years attracted the attention of obstetricians, and it is now well known to be associated, in ways still imperfectly understood, with many important puerperal diseases. Its presence in most cases of puerperal eclampsia was long ago pointed out by Lever in this country, and Rayer in France, and its association with this disease gave rise to the theory of the dependence of the convulsions on uræmia, which is still generally entertained. It has been shown of late years, especially by Braxton Hicks, that this association is by no means so universal as was supposed; or rather that, in some cases, the albuminuria follows and does not precede the convulsions, of which it might therefore be supposed to be the consequence rather than the cause; so that further investigation as to these particular points is still required. Modern researches have shown that there is an intimate connection between many other affections and albuminuria; as, for example, certain forms of paralysis, either of special nerves, as puerperal amaurosis, or of the spinal system; other nervous phenomena, as cephalalgia and dizziness, puerperal mania, and possibly hemorrhage. It cannot, therefore, be doubted that albuminuria in the pregnant woman is liable, at any rate, to be associated with grave disease, although the present state of our knowledge does not enable us to define very distinctly its precise mode of action.

Causes of Puerperal Albuminuria.—As the presence of albumen in the urine of pregnant women is far from a rare phenomenon, being met with, according to the researches of Blot and Litzman, in 20 per cent. of pregnant women, and as in the large majority of these cases it rapidly disappears after delivery, it is obvious that its presence must in a large proportion of cases depend on temporary causes, and that its existence in the urine has not always the same serious importance as in the non-pregnant state. This is further proved by the undoubted fact that albumen, rapidly disappearing after delivery, is often found in the urine of pregnant women who go to term and pass through labor without any unfavorable symptoms.

Pressure.—The obvious fact that in pregnancy the vessels supplying the kidneys are subjected to mechanical pressure from the gravid uterus, and that congestion of the venous circulation of those viscera must, therefore, necessarily exist to a greater or less degree, suggests that here we may find an explanation of the frequent existence of albuminuria during gestation. This view is further strengthened by the fact that the albumen rarely appears until after the fifth month, and therefore not until the uterus has attained a considerable size, and also that it is comparatively more frequently met with in primiparæ, in whom the resistance of the abdominal parietes, and consequent pressure, must be greater than in women who have already borne children. It is, indeed, probable that pressure and consequent venous congestion of the kidneys have an important influence in its production; but there must be, as a rule, some other factor in operation, since an equal or even greater amount of pressure is often exerted by ovarian and fibroid tumors, without any such consequences.

Altered State of the Blood.—This is probably to be found in the altered condition of the blood, which, on account of the unusual call for nutritive supply on the part of the fœtus, contains an excess of albuminous material. Hence we have two factors always at work in the pregnant woman, both predisposing to the escape of albumen, viz., a turgid state of the renal venous system, and a super-albuminous condition of the blood. But in the large majority of cases, although these conditions are present, no albuminuria exists; and they must therefore be looked upon as predisposing causes, to which some other is added before the albumen escapes from the vessels. What this is generally escapes our observation, but probably any condition producing sudden hyperæmia of the kidneys and giving rise to a state analogous to the first stage of Bright's disease—such, for example, as sudden exposure to cold and impeded cutaneous action—may be sufficient to set a light to the match already prepared by the existence of pregnancy. In addition to these temporary causes it must not be forgotten that pregnancy may supervene in a patient already suffering from Bright's disease, when of course the albumen will exist in the urine from the commencement of gestation.

The various diseases associated with the presence of albumen in the urine will require separate consideration. Some of these, especially puerperal eclampsia, are amongst the most dangerous complications of pregnancy. Others, such as paralysis, cephalalgia, dizziness, may also be of considerable gravity. The precise mode of their production, and whether they can be traced, as is generally believed, to the retention of urinary elements in the blood, either urea or free carbonate of ammonia produced by its decomposition, or whether the two are only common results of some undetermined cause, must also be considered when we come to discuss puerperal convulsions. Whatever view may ultimately be taken on these points, it is sufficiently obvious that the existence of albuminuria in a pregnant woman must constantly be a source of much anxiety, and must induce us to look forward with considerable apprehension to the termination of the case.

Prognosis.—We are scarcely in possession of a sufficiently large number of observations to justify any very accurate conclusions as to the risk attending albuminuria during pregnancy, but it is certainly by no means slight. One source of danger is that the morbid state of the kidneys may become permanent, and may lead to the establishment of distinct Bright's disease after the pregnancy is over. Goubeyre estimated that 49 per cent. of primiparæ who have albuminuria, and who escape eclampsia, die from morbid conditions traceable to the albuminuria. This conclusion is probably much exaggerated, but, if it even approximates to the truth, the danger must be very great.

Tendency to produce Abortion.—Besides the ultimate risk to the mother, the existence of albuminuria strongly predisposes to abortion, no doubt on account of the imperfect nutrition of the fœtus by blood impoverished by the drain of albuminous materials through the kidneys. This fact has been observed by many writers. A good illustration of it is given by Tanner,[1] who states that four out of seven women he attended suffering from Bright's disease during pregnancy aborted, one of them three times in succession.

The symptoms accompanying albuminuria in pregnancy are by no means uniform or constantly present. That which most frequently causes suspicion is the existence of anasarca, not only the œdematous swelling of the lower limbs which is so common a consequence of the pressure of the gravid uterus, but also of the face and upper extremities. Any degree of puffiness or infiltration about the face, or any œdema about the hands or arms, should always give rise to suspicion, and lead to a careful examination of the urine. Sometimes this is carried to an exaggerated degree, so that there is anasarca of the whole body.

Anomalous nervous symptoms, such as headache, transient dizziness or dimness of vision, spots before the eyes, inability to see objects distinctly, sickness in women not at other times suffering from sympathetic nausea, sleeplessness, irritability of temper, are also often met with, sometimes to a slight degree, at others very strongly developed, and should always arouse suspicion. Indeed, knowing as we do that many morbid states may be associated with albuminuria, we should make a point of carefully examining the urine of all patients in whom any unusual morbid phenomena show themselves during pregnancy.

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[1] Signs and Diseases of Pregnancy, p. 428.

The condition of the urine varies considerably, but it is generally scanty and highly colored, and, in addition to the albumen, especially in cases in which the albuminuria has existed for some time, we may find epithelium cells, tube casts, and occasionally blood corpuscles.

Treatment.—The *treatment* must be based on what has been said as to the causes of the albuminuria. Of course it is out of our power to remove the pressure of the gravid uterus, except by inducing labor; but its effects may at least be lessened by remedies tending to promote an increased secretion of urine, and thus diminishing the congestion of the renal vessels. The administration of saline diuretics, such as the acetate of potash, or bitartrate of potash, the latter being given in the form of the well-known imperial drink, will best answer this indication. The action of the bowels may be solicited by purgatives producing watery motions, such as occasional doses of the compound jalap powder. Dry cupping over the loins, frequently repeated, has a beneficial effect in lessening the renal hyperæmia. The action of the skin should also be favored by the use of the vapor bath, and with this view the Turkish bath may be employed with great benefit and perfect safety. The next indication is to improve the condition of the blood by appropriate diet and medication. The tincture of the perchloride of iron is the best medicine for the purpose, and it may be advantageously combined with small doses of tincture of digitalis, which acts as an excellent diuretic.

Finally, in obstinate cases we shall have to consider the advisability of removing the cause by the induction of premature labor. The propriety of this procedure in the albuminuria of pregnancy has of late years been much discussed, and I believe that, having in view the undoubted risks which attend this complication, the operation is unquestionably indicated, and is perfectly justifiable, in all cases attended with symptoms of gravity. It is not easy to lay down any definite rules to guide our decision; but I should not hesitate to adopt this resource in all cases in which the amount of albumen is considerable and progressively increasing, in which treatment has failed to lessen the amount; and, above all, in every case attended with threatening symptoms, such as severe headache, dizziness, or loss of sight. The risks of the operation are infinitesimal compared to those which the patient would run in the event of puerperal convulsions supervening or chronic Bright's disease becoming established. As the operation is seldom likely to be indicated until the child has reached a viable age, and as the albuminuria places the child's life in danger, we are quite justified in considering the mother's safety alone in determining on its performance.

CHAPTER VIII.

DISEASES OF PREGNANCY (CONTINUED).

Disorders of the Nervous System.—There are many disorders of the nervous system met with during the course of pregnancy. Among the most common are morbid irritability of temper, or a state of mental despondency and dread of the results of the labor, sometimes amounting almost to insanity, or even progressing to actual mania. These are but exaggerations of the highly susceptible state of the nervous system generally associated with gestation. Want of sleep is not uncommon, and, if carried to any great extent, may produce serious trouble from the condition of irritability and exhaustion it produces. In such cases we should endeavor to lessen the excitable state of the nerves resulting in insomnia, by insisting on the avoidance of late hours, over-much society, exciting amusements, and the like; while it may be essential to promote sleep by the administration of sedatives, none answering so well as the chloral hydrate, in combination with large doses of the bromide of potassium, which greatly intensifies its hypnotic effects.

Severe *headaches* and various intense *neuralgiæ* are common. Amongst the latter the most frequently met with are pain in the breasts, due to the intimate sympathetic connection of the mammæ with the gravid uterus; and intense intercostal neuralgia, which a careless observer might mistake for pleuritic or inflammatory pain. The thermometer, by showing that there is no elevation of temperature, would prevent such a mistake. Neuralgic affections of the uterus itself, or severe pains in the groins or thighs, the latter being probably the mechanical results of dragging on the attachments of the abdominal muscles, are also far from uncommon. In the treatment of such neuralgic affections attention to the state of the general health, and large doses of quinine and ferruginous preparations wherever there is much debility, will be indicated. Locally, sedative applications, such as belladonna and chloroform liniments, friction with aconite ointment when the pain is limited to a small space, and, in the worst cases, the subcutaneous injection of morphia, will be called for. Those pains which apparently depend on mechanical causes may often be best relieved by lessening the traction on the muscles, by wearing a well-made elastic belt to support the uterus.

Paralysis.—Among the most interesting of the nervous affections are various paralytic affections. Almost all varieties of paralysis have been observed, such as paraplegia, hemiplegia (complete or incomplete), facial paralysis, and paralysis of the nerves of special sense, giving rise to amaurosis, deafness, and loss of the sense of taste. Churchill records twenty-two cases of paralysis during pregnancy, collected by him from various sources. A large number have also been brought together by Imbert Gourbeyre,[1] in an interesting memoir on the subject, and other cases are recorded by Fordyce Barker, Hellft, Joulin, and other authors; so that there can be no doubt of the fact that paralytic affections are comparatively common during gestation. In the large proportion of the cases recorded the paralyses have been associated with albuminuria, and are doubtless uræmic in origin. Thus, in nineteen cases related by Gourbeyre, albuminuria was present in all. The dependency of the paralysis on a transient cause explains the fact that in the large majority of these cases the paralysis was not permanent, but disappeared shortly after labor. In every case of paralysis, whatever be its nature, special attention should be directed to the state of the urine, and, should it be found to be albuminous, labor should be at once induced. This is clearly the proper course to pursue, and we should certainly not be justified in running the risk that must attend the progress of a case in which so formidable a symptom has already developed itself. When the cause has been removed, the effect will also generally rapidly disappear, and the prognosis is therefore, on the whole, favorable. Should the paralysis continue after delivery, the treatment must be such as we would adopt in the non-pregnant state; and small doses of strychnia, along with faradization of the affected limbs, would be the best remedy at our disposal.

There are, however, unquestionably some cases of puerperal paralysis which are not uræmic in their origin, and the nature of which is somewhat obscure. Hemiplegia may doubtless be occasioned by cerebral hemorrhage, as in the non-pregnant state. Other organic causes of paralysis, such as cerebral congestion, or embolism, may now and again be met with during pregnancy, but cases of this kind must be of comparative rarity. Other cases are functional in their origin. Tarnier relates a case of hemiplegia which he could only refer to extreme anæmia. Some, again, may be hysterical. Paraplegia is apparently more frequently unconnected with albuminuria than the other forms of paralysis; and it may either depend on pressure of the gravid uterus on the nerves as they pass through the pelvis, or on reflex action, as is sometimes observed in connection with uterine disease. When, in such cases, the absence of albuminuria is ascertained by frequent examination of the urine, there is obviously not the same risk to the patient as in cases depending on uræmia, and therefore it may be justifiable to allow pregnancy to go on to term, trusting to subsequent general treatment to remove the paralytic symptoms. As the loss of power here depends on a transient cause, a favorable prognosis is quite justifiable.

Chorea is not unfrequently observed, and forms a serious complication. It is generally met with in young women of delicate health and in the first pregnancy. In a large proportion of the cases the patient has already suffered from the disease before marriage. On the occurrence of pregnancy, however, the disposition to the disease again becomes evoked, and choreic movements are re-established. This fact may be explained partly by the susceptible state of the nervous system, partly by the impoverished condition of the blood.

Prognosis.—That chorea is a dangerous complication of pregnancy is apparent by the fact that out of fifty-six cases collected by Dr. Barnes,[1] in an excellent paper on the subject, no less than seventeen, or one in three, proved fatal. Nor is it danger to life alone that is to be feared, for it appears certain that the chorea is more apt to leave permanent mental disturbance, when it occurs during pregnancy, than at other times.[2] It has also an unquestionable tendency to bring on abortion or premature labor, and in most cases the life of the child is sacrificed.

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[1] Mém. de l'Acad. de Méd., 1801.

The treatment of chorea during pregnancy does not differ from that of the disease under more ordinary circumstances; and our chief reliance will be placed on such drugs as the liquor arsenicalis, bromide of potassium, and on various preparations of iron. In the severer form of the disease, however, the incessant movements, and the weariness and loss of sleep, may very seriously imperil the life of the patient, and more prompt and radical measures will be indicated. If, in spite of our remedies, the paroxysms go on increasing in severity, and the patient's strength appears to be exhausted, our only resource is to remove the most evident cause by inducing labor. Generally the symptoms lessen and disappear soon after this is done. There can be no question that the operation is perfectly justifiable, and may even be essential under such circumstances. It should be borne in mind that the chorea often recurs in a subsequent pregnancy, and extra care should then always be taken to prevent its development.

Disorders of the urinary organs are of frequent occurrence. Retention of urine may be met with, and this is often the result of a retroverted condition of the gravid uterus. The treatment, therefore, must then be directed to the removal of the cause. This subject will be more particularly considered when we come to discuss that form of displacement (p. 193); but we may here point out that retention of urine, if long continued, may not only lead to much distress, but to actual disease of the coats of the bladder. Several cases have been recorded in which cystitis, resulting from urinary retention in pregnancy, eventually caused the exfoliation of the entire mucous membrane of the bladder,[3] which was cast off, sometimes entire, sometimes in shreds, and occasionally with portions of the muscular coat attached to it. The possibility of this formidable accident should teach us to be careful not to allow any undue retention of urine, but, by a timely use of the catheter, to relieve the symptoms, while we at the same time endeavor to remove the cause.

Irritability of the bladder is of frequent occurrence. In the early months it seems to be the consequence of sympathetic irritation of the neck of the bladder, combined with pressure, while in the later months it is, probably, solely produced by mechanical causes. When severe, it leads to much distress, the patient's rest being broken and disturbed by incessant calls to micturate, and the suffering induced may produce serious constitutional disturbances. I have elsewhere pointed out[4] that irritability of the bladder in the latter months of pregnancy is frequently associated with an abnormal position of the fœtus, which is placed transversely or obliquely. The result is either that undue pressure is applied to the bladder, or that it is drawn out of its proper position. The abnormal position of the fœtus can readily be detected by palpation, and as readily altered by external manipulation. In some of the cases I have recorded, altering the position of the fœtus was immediately followed by relief; the symptoms recurring after a time, when the fœtus had again assumed an oblique position. Should the fœtus frequently become displaced, an endeavor may be made to retain it in the longitudinal axis of the uterus by a proper adaptation of bandages or pads. In cases not referable to this cause we should attempt to relieve the bladder symptoms by appropriate medication, such as small doses of liquor potassæ, if the urine be very acid; tincture of belladonna; the decoction of triticum repens, an old but very serviceable remedy; and vaginal sedative pessaries containing morphia or atropine.

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[1] Obst. Trans., vol. x.

[2] Brit. Med. Journ., June, July, and Oct., 1871.

[3] Obst. Trans., vol. xi.

[4] Ibid., vol. xiii.

Incontinence of Urine.—Women who have borne many children are often troubled with incontinence of urine during pregnancy, the water dribbling away on the slightest movement. Through this much irritation of the skin surrounding the genitals is produced, attended with troublesome excoriations and eruptions. Relief may be partially obtained by lessening the pressure on the bladder by an abdominal belt, while the skin is protected by applications of simple ointment or glycerine.

Phosphatic Deposit.—Dr. Tyler Smith has directed attention to a phosphatic condition of the urine occurring in delicate women, whose constitutions are severely tried by gestation. This condition can easily be altered by rest, nutritious diet, and a course of restorative medicines, such as steel, mineral acids, and the like.

Leucorrhœa.—A profuse whitish leucorrhœal discharge is very common during pregnancy, especially in its latter half. The discharge frequently alarms the patient, but, unless it is attended with disagreeable symptoms, it does not call for special treatment. When at all excessive, however, it may lead to much irritation of the vagina and external generative organs. The labia may become excoriated and covered with small aphthous vesicles, and the whole vulva may be hot, swollen, and tender. Warty growths, similar in appearance to syphilitic condylomata, are occasionally developed in pregnant women, unconnected with any specific taint, and associated with the presence of an irritating leucorrhœal discharge. According to Thibierge,[1] these resist local applications, such as sulphate of copper or nitrate of silver, but spontaneously disappear after delivery. Inasmuch as the leucorrhœal discharge is dependent on the congested condition of the generative organs accompanying pregnancy, we can hope to do little more than alleviate it. In the severer forms, as has been pointed out by Henry Bennett, the cervix will be found to be abraded or covered with granular erosion, and it may be, from time to time, cautiously touched with the nitrate of silver, or a solution of carbolic acid. Generally speaking, we must content ourselves with recommending the patient to wash the vagina out gently with diluted Condy's fluid; or with a solution of the sulpho-carbolate of zinc, of the strength of four grains to the ounce of water; or with plain tepid water. For obvious reasons, frequent and strong vaginal douches are to be avoided; but a daily gentle injection, for the purpose of ablution, can do no harm.

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[1] Arch. Gén. de Méd., 1856.

Pruritus.—A very distressing pruritus of the vulva is frequently met with along with leucorrhœa, especially when the discharge is of an acrid character, which in some cases leads to intense and protracted suffering, forcing the patient to resort to incessant friction of the parts. Pruritus, however, may exist without leucorrhœa, being apparently sometimes of a neuralgic character, at others associated with aphthous patches on the mucous membrane, ascarides in the rectum, or pediculi in the hairs of the mons veneris and labia. Cases are even recorded in which the pruritic irritation extended over the whole body. The treatment is difficult and unsatisfactory. Various sedative applications may be tried, such as weak solutions of Goulard's lotion; or a lotion composed of an ounce of the solution of the muriate of morphia, with a drachm and a half of hydrocyanic acid, in six ounces of water; or one formed by mixing one part of chloroform with six of almond oil. A very useful form of medication consists in the insertion into the vagina of a pledget of cotton wool, soaked in equal parts of the glycerine of borax and sulphurous acid. This may be inserted at bedtime, and withdrawn in the morning by means of a string attached to it. In the more obstinate cases, the solid nitrate of silver may be lightly brushed over the vulva; or, as recommended by Tarnier, a solution of bichloride of mercury, of about the strength of two grains to the ounce, may be applied night and morning. The state of the digestive organs should always be attended to, and aperient mineral water may be usefully administered. When the pruritus extends beyond the vulva, or even in severe local cases, large doses of bromide of potassium may perhaps be useful in lessening the general hyperæsthetic state of the nerves.

Effects of Pressure.—Some of the disorders of pregnancy are the direct results of the mechanical pressure of the gravid uterus. The most common of these are œdema and a varicose state of the veins of the lower extremities, or even of the vulva itself. The former is of little consequence, provided we have assured ourselves that it is really the result of pressure, and not of albuminuria, and it can generally be relieved by rest in the horizontal position. A varicose state of the veins of the lower limbs is very common, especially in multiparæ, in whom it is apt to continue after delivery. Occasionally the veins of the vulva, and even of the vagina itself, are also enlarged and varicose, producing considerable swelling of the external genitals. Rest in the recumbent position, and the use of an abdominal belt, so as to take the pressure off the veins as much as possible, are all that can be done to relieve this troublesome complication. If the veins of the legs are much swollen, some benefit may be derived from an elastic stocking or a carefully-applied bandage.

Serious and even fatal consequences have followed the accidental laceration of the swollen veins. When laceration occurs during or immediately after delivery—a not uncommon result of the pressure of the head—it gives rise to the formation of a vaginal thrombus. It has occasionally happened from an accidental injury during pregnancy, as in the cases recorded by Simpson, in which death followed a kick on the pudenda, producing laceration of a varicose vein, or in the one mentioned by Tarnier, where the patient fell on the edge of a chair. Severe hemorrhage has followed the accidental rupture of a vein in the leg. The only satisfactory treatment is pressure, applied directly to the bleeding parts by means of the finger, or by compresses saturated in a solution of the perchloride of iron. The treatment of vaginal thrombus following labor must be elsewhere considered. Occasionally the varicose veins inflame, become very tender and painful, and coagula form in their canals. In such cases absolute rest should be insisted on, while sedative lotions, such as the chloroform and belladonna liniments, should be applied to relieve the pain.

Certain displacements of the gravid uterus are met with, which may give rise to symptoms of great gravity.

Prolapse, which is rare, is almost always the result of pregnancy occurring in a uterus which had been previously more or less procident. Under such circumstances the increasing weight of the uterus will at first necessarily augment the previously existing tendency to protrusion of the womb, which may come to lie partially or entirely beyond the vulva. In the great majority of cases, however, as pregnancy advances, the prolapsus cures itself, for at or about the fourth or fifth month the uterus will rise above the pelvic brim. It has been said, however, that in some cases of complete procidentia, pregnancy has gone on even to term, with the uterus lying entirely outside the vulva. Most probably these cases were imperfectly observed, the greater part of the uterus being in reality above the pelvic brim, a portion only of its lower segment protruding externally; or, as has sometimes been the case, the protruding portion has been an old standing hypertrophic elongation of the cervix, the internal os uteri and fundus being normally situated. Should a prolapsed uterus not rise into the abdominal cavity as pregnancy advances, serious symptoms will be apt to develop themselves; for, unless the pelvis be unusually capacious, the enlarging uterus will get jammed within its bony walls, the rectum and urethra will be pressed upon, defecation and micturition will be consequently impeded, and severe pain and much irritation will result. In all probability such a state of things would lead to abortion. The possibility of these consequences should, therefore, teach us to be careful in the management of every case of prolapsus, however slight, in which pregnancy occurs. The most absolute rest, in the horizontal position, should be insisted on; while the uterus should be supported in the pelvis by a full-sized Hodge's pessary, which should be worn until at least the sixth month, when the uterus would be fully within the abdominal cavity. After delivery, very prolonged rest should be insisted on, in the hope that the process of involution may be accompanied by a cure of the prolapse. There can be no doubt that pregnancy carried to term affords an opportunity of curing even old-standing displacements, which should not be neglected.

Anteversion of the gravid uterus seldom produces symptoms of consequence. In all probability it is common enough when pregnancy occurs in a uterus which is more than usually anteverted, or is ante-flexed. Under such circumstances, there is not the same risk of incarceration in the pelvic cavity as in cases in which pregnancy exists in a retroflexed uterus, for as the uterus increases in size it rises without difficulty into the abdominal cavity. In the early months the pressure of the fundus on the bladder may account for the irritability of that viscus then so commonly observed. It will be remembered that Dr. Graily Hewitt attributes great importance to this condition as explaining the sickness of pregnancy—a theory, however, which has not met with general acceptation.

Extreme anteversion of the uterus, at an advanced period of pregnancy, is sometimes observed in multiparæ with very lax abdominal walls, occasionally to such an extent that the uterus falls completely forwards and downwards, so that the fundus is almost on a level with the patient's knees. This form of pendulous belly may be associated with a separation of the recti muscles, between which the womb forms a ventral hernia, covered only by the cutaneous textures. When labor comes on, this variety of displacement may give rise to trouble by destroying the proper relation of the uterine and pelvic axes. The treatment is purely mechanical, keeping the patient lying on her back as much as possible, and supporting the pendulous abdomen by a properly adjusted bandage. A similar forward displacement is observed in cases of pelvic deformity; and in the worst forms, in rachitic and dwarfed women, it exists to a very exaggerated degree.

Retroversion.—The most important of the displacements, in consequence of its occasional very serious results, is retroversion of the gravid uterus. It was formerly generally believed that this was most commonly produced by some accident, such as a fall, which mechanically dislocated a uterus previously in a normal position. Undue distension of the bladder was also considered to have an important influence in its production, by pressing the uterus backwards and downwards.

Its Causes.—It is now almost universally admitted that, although the above-named causes may possibly sometimes produce it, in the very large proportion of cases it depends on pregnancy having occurred in a uterus previously retroverted or retroflexed. The merit of pointing out this fact unquestionably belongs to the late Dr. Tyler Smith, and further observations have fully corroborated the correctness of his views.

In the large majority of cases in which pregnancy occurs in a uterus so displaced, as the womb enlarges, it straightens itself, and rises into the abdominal cavity, without giving any particular trouble; or, as not unfrequently happens, the abnormal shape of the organ interferes so much with its enlargement as to produce abortion. Sometimes, however, the uterus increases without leaving the pelvis until the third or fourth month, when it can no longer be retained in the pelvic cavity without inconvenience. It then presses on the urethra and rectum, and eventually becomes completely incarcerated within the rigid walls of the bony pelvis, giving rise to characteristic symptoms.

Symptoms.—The first sign which attracts attention is generally some trouble connected with micturition, in consequence of pressure on the urethra. On examination, the bladder will often be found to be enormously distended, forming a large, fluctuating, abdominal tumor, which the patient has lost all power of emptying. Frequently small quantities of urine dribble away, leading the woman to believe that she has passed water, and thus the distension is often overlooked. Sometimes the obstruction to the discharge of urine is so great as to lead to dropsical effusion into the cellular tissue of the arms and legs. This was very well marked in one of my cases, and disappeared rapidly after the bladder had been emptied. Difficulty in defecation, tenesmus, obstinate constipation, and inability to empty the bowels, become established about the same time. These symptoms increase, accompanied by some pelvic pain and a sense of weight and bearing down, until at last the patient applies for advice, and the true nature of the case is detected. When the retroversion occurs suddenly, all these symptoms develop with great rapidity, and are sometimes very serious from the first.

The farther progress is various. Sometimes, after the uterus has been incarcerated in the pelvis for more or less time, it may spontaneously rise into the abdominal cavity, when all threatening symptoms will disappear. So happy a termination is quite exceptional, and, if the practitioner should not interfere and effect reposition of the organ, serious and even fatal consequences may ensue, unless spontaneous abortion comes on. The extreme distension of the bladder, and the impossibility of relieving it, may lead to laceration of its coats, and fatal peritonitis; or the retention of urine may produce cystitis, with exfoliation of the coats of the bladder; or, as more commonly happens, retention of urinary elements may take place, and death occur with all the symptoms of uræmic poisoning. At other times the impacted uterus becomes congested and inflamed, and eventually sloughs, its contents, if the patient survives, being discharged by fistulous communications into the rectum and vagina. It need hardly be said that such terminations are only possible in cases which have been grossly mismanaged, or the nature of which has not been detected till a late period.

The *diagnosis* is not difficult. On making a vaginal examination, the finger impinges on a smooth rounded elastic swelling, filling up the lower part of the pelvis, and stretching and depressing the posterior vaginal wall, which occasionally protrudes beyond the vulva. On passing the finger forwards and upwards, we shall generally be able to reach the cervix, high up behind the pubes, and pressing on the urethral canal. In very complete retroversion it may be difficult or impossible to reach the cervix at all. On abdominal examination the fundus uteri cannot be felt above the pelvic brim, which, as the retroversion does not give rise to serious symptoms until between the third and fourth month, should, under natural circumstances, always be possible. By bi-manual examination we can make out, with due care, the alternate relaxation and contraction of the uterine parietes characteristic of the gravid uterus, and so differentiate the swelling from any other in the same situation. The accompanying phenomena of pregnancy will also prevent any mistake of this kind.

In some few cases retroversion has been supposed to go on to term. Strictly speaking, this is impossible; but in the supposed examples, such as in the well-known case recorded by Oldham, part of a retroflexed uterus remained in the pelvic cavity, while the greater part of the organ developed in the abdominal cavity. The uterus is, therefore, divided, as it were, into two sacs; the one, which is the flexed fundus, remaining in the pelvis, the other, containing the greater part of the fœtus, rising above it. Under these circumstances, a swelling in the vagina would exist in combination with an abdominal tumor, and pregnancy might go on to term. Considerable difficulty might even arise in labor, although the malposition generally rectifies itself before it gives rise to any serious results.

The *treatment* of retroversion of the gravid uterus should be taken in hand as soon as possible, for every day's delay involves an increase in the size of the uterus, and, therefore, greater difficulty in reposition. Our object is to restore the natural direction of the uterus, by lifting the fundus above the promontory of the sacrum. The first thing to be done is to relieve the patient by emptying the bladder, the retention of urine having probably originally called attention to the case. For this purpose it is essential to use a long elastic male catheter of small size, as the urethra is too elongated and compressed to admit of the passage of the ordinary silver instrument. Even then it may be extremely difficult to introduce the catheter, and sometimes it has been found to be quite impossible. Under such circumstances, provided reposition cannot be effected without it, the bladder may be punctured an inch or two above the pubes by means of the fine needle of an aspirator, and the water drawn off. Dieulafoy's work on aspiration proves conclusively that this may be done without risk, and the operation has been successfully performed by Scacht and others. It very rarely happens, however, and in long-neglected cases only, that the withdrawal of the urine is found to be impossible.

Mode of Effecting Reduction.—The bladder being emptied, and the bowels being also opened, if possible, by copious enemata, we proceed to attempt reduction. For this purpose various procedures are adopted. If the case is not of very long standing, I am inclined to think that the gentlest and safest plan is the continuous pressure of a caoutchouc bag, filled with water, placed in the vagina. The good effects of steady and long-continued pressure of this kind were proved by Tyler Smith, who effected in this way the reduction of an inverted uterus of long standing; and it is not difficult to understand that it may succeed when a more sudden and violent effort fails. I have tried this plan successfully in two cases, a pyriform india-rubber bag being inserted into the vagina and distended as far as the patient can bear by means of a syringe. The water must be let out occasionally, to allow the patient to empty the bladder, and the bag immediately refilled. In both my cases reposition occurred within twenty-four hours. Barnes has failed with this method, but it succeeded so well in my cases, and is so obviously less likely to prove hurtful than forcible reposition with the hand, that I am inclined to consider it the preferable procedure, and one that should be tried first. Failing with the fluid pressure, we should endeavor to replace the uterus in the following way. The patient should be placed at the edge of the bed, in the ordinary obstetric position, and thoroughly anæsthetized. This is of importance, as it relaxes all the parts, and admits of much freer manipulation than is otherwise possible. One or more fingers of the left hand are then inserted into the rectum; if the patient is deeply chloroformed, it is quite possible, with due care, even to pass the whole hand; and an attempt is then made to lift or push the fundus above the promontory of the sacrum. At the same time reposition is aided by drawing down the cervix with the fingers of the right hand per vaginam. It has been insisted that the pressure should be made in the direction of one or other sacro-iliac synchondrosis rather than directly upwards, so that the uterus may not be jammed against the projection of the promontory of the sacrum. Failing reposition through the rectum, an attempt may be made per vaginam, and for this some have advised the upward pressure of the closed fist passed into the canal. Others recommend the hand and knee position as facilitating reposition, but this prevents the administration of chloroform, which is of more assistance than any change of position can possibly be. Various complex instruments have been invented to facilitate the operation, but they are all more or less dangerous, and are unlikely to succeed when manual pressure has failed.

As soon as the reduction is accomplished, subsequent descent of the uterus should be prevented by a large-sized Hodge's pessary, and the patient should be kept at rest for some days, the state of the bladder and bowels being particularly attended to. When reposition has been fairly effected, a relapse is unlikely to occur.

In cases in which reduction is found to be impossible, our only resource is the artificial induction of abortion. Under such circumstances this is imperatively called for. It is best effected by puncturing the membranes, the discharge of the liquor amnii of itself lessening the size of the uterus, and thus diminishing the pressure to which the neighboring parts are subjected. After this, reposition may be possible, or we may wait until the fœtus is spontaneously expelled. It is not always easy to reach the os uteri, although we can generally do so with a curved uterine sound. If we cannot puncture the membranes, the liquor amnii may be drawn off through the uterine walls by means of the aspirator, inserted through either the rectum or vagina. The injury to the uterine walls thus inflicted is not likely to be hurtful, and the risk is certainly far less than leaving the case alone. Naturally, so extreme a measure would not be adopted until all the simpler means indicated have been tried and failed.

Diseases co-existing with Pregnancy.—The pregnant woman is, of course, liable to contract the same diseases as in the non-pregnant state, and pregnancy may occur in women already the subject of some constitutional disease. There is no doubt yet much to be learnt as to the influence of co-existing disease on pregnancy. It is certain that some diseases are but little modified by pregnancy, and that others are so to a considerable extent; and that the influence of the disease on the fœtus varies much. The subject is too extensive to be entered into at any length, but a few words may be said as to some of the more important affections that are likely to be met with.

The eruptive fevers have often very serious consequences, proportionate to the intensity of the attack. Of these variola has the most disastrous results, which are related in the writings of the [illegible]hors, but which are, fortunately, rarely seen in these days of vaccination. The severe and confluent forms of the disease are almost certainly fatal to both the mother and child. In the discrete form, and in modified small-pox after vaccination, the patient generally has the disease favorably, and, although abortion frequently results, it does not do so necessarily.

If scarlet fever of an intense character attacks a pregnant woman, abortion is likely to occur, and the risks to the mother are very great. The milder cases run their course without the production of any untoward symptoms. Should abortion occur, the well-known dangerous effect of this zymotic disease after delivery will necessarily gravely influence the prognosis. Cazeaux is of opinion that pregnant women are not apt to contract the disease; while Montgomery thought that the poison when absorbed during pregnancy might remain latent until delivery, when its characteristic effects were produced.

Measles, unless very severe, often runs its course without seriously affecting the mother or child. I have myself seen several examples of this. De Tourcoing, however, states that out of fifteen cases the mothers aborted in seven, these being all very severe attacks. Some cases are recorded in which the child was born with the rubeolous eruption upon it.

Continued Fever.—The pregnant woman may be attacked with any of the continued fevers, and, if they are at all severe, they are apt to produce abortion. Out of twenty-two cases of typhoid, sixteen aborted, and the remaining six, who had slight attacks, went on to term; out of sixty-three cases of relapsing fever, abortion or premature labor occurred in twenty-three. According to Schweden, the main cause of danger to the fœtus in continued fever is the hyperpyrexia, especially when the maternal temperature reaches 104° or upwards. The fevers do not appear to be aggravated as regards the mother; and the same observation has been made by Cazeaux with regard to this class of disease occurring after delivery.

Pneumonia seems to be specially dangerous, for of fifteen cases collected by Grisolle[1] eleven died—a mortality immensely greater than that of the disease in general. The larger proportion also aborted, the children being generally dead, and the fatal result is probably due, as in the severe continued fevers, to hyperpyrexia. The cause of the maternal mortality does not seem quite apparent, since the same danger does not appear to exist in severe bronchitis, or other inflammatory affections.

Phthisis.—Contrary to the usually received opinion, it appears certain that pregnancy has no retarding influence on co-existing phthisis, nor does the disease appear necessarily to advance with greater rapidity after delivery. Out of twenty-seven cases of phthisis, collected by Grisolle,[2] twenty-four showed the first symptoms of the disease after pregnancy had commenced. It is tolerably certain that phthisical women are not apt to conceive—a fact which may probably be explained by the frequent co-existence, in such cases, of uterine disease, especially severe leucorrhœa. The entire duration of the phthisis seems to be shortened, as it averaged only nine and a half months in the twenty-seven cases collected—a fact which proves, at least, that pregnancy has no material influence in arresting its progress. If we consider the tax on the vital powers which pregnancy naturally involves, we must admit that this view is more physiologically probable than the one generally received and apparently adopted without any due grounds.

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[1] Arch. Gén. de Méd., vol. xiii. p. 291.

[2] Ibid., vol. xxii.

Cardiac Disease.—The bad effects of pregnancy on pre-existing organic disease of the heart have been especially insisted on by Peter,[1] who refers the aggravation of the symptoms which he has generally observed partly to the increase of the whole quantity of blood circulating in the vessels, and partly to the physiological hypertrophy of the heart, both of which normally occur during gestation.

Syphilis.—The important influence of syphilis on the ovum is fully considered elsewhere. As regards the mother, its effects are not different from those at other times. It need only, therefore, be said that, whenever indications of syphilis in a pregnant woman exist, the appropriate treatment should be at once instituted and carried on during her gestation, not only with the view of checking the progress of the disease, but in the hope of preventing or lessening the risk of abortion, or of the birth of an infected infant. So far from pregnancy contraindicating mercurial treatment, it rather is a reason for insisting on it more strongly. As to the precise medication, it is advisable to choose a form that can be exhibited continuously for a length of time without producing serious constitutional results. Small doses of the bichloride of mercury, such as one-sixteenth of a grain, thrice daily, or of the iodide of mercury, answer this purpose well; or, in the early stages of pregnancy, the mercurial vapor bath, or cutaneous inunction, may be employed.

Dr. Weber, of St. Petersburg,[2] has made some observations showing the superiority of the latter methods, which he found did not interfere with the course of pregnancy, while the contrary was the case when the mercury was administered by the mouth, probably, as he supposes, from the disturbance of the digestive system it then produced. It must be borne in mind, however, that in married women it may sometimes be expedient to prescribe an anti-syphilitic course without their knowledge of its nature; so that the cutaneous channel for the exhibition of the drug is not always feasible.

Epilepsy.—The influence of pregnancy on epilepsy does not appear to be as uniform as might perhaps be expected. In some cases the number and intensity of the fits have been lessened, in others the disease becomes aggravated. Some cases are even recorded in which epilepsy then appeared for the first time. On account of the resemblance between epilepsy and eclampsia, there is often a natural apprehension that a pregnant epileptic may suffer from convulsions during delivery. Fortunately, this is by no means necessarily the case, and labor often goes on satisfactorily without any attack.

Jaundice, the result of acute yellow atrophy of the liver, is occasionally observed, and is said to have been sometimes epidemic. Independently of the grave risks to the mother, it is most likely to produce the death of the fœtus and abortion. According to Davidsohn, it originates in catarrhal icterus, the excretion of the bile-products being impeded in consequence of pregnancy, and their retention giving rise to the fœtal blood-poisoning which accompanies the severer forms of the disease. Slight and transient attacks of jaundice may occur, without being accompanied by any bad consequences. Their production is probably favored by the mechanical pressure of the gravid uterus on the intestines and the bile-ducts.

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[1] L'Union Médicale.

[2] Allgem. Med. Cent. Zeit., Feb. 1875.

Carcinoma.—The occurrence of pregnancy in a woman suffering from malignant disease of the uterus is by no means so rare as might be supposed, and must naturally give rise to much anxiety as to the result. The obstetrical treatment of these cases will be discussed elsewhere. Should we be aware of the existence of the disease during gestation, the question will arise whether we should not attempt to lessen the risks of delivery by bringing on abortion or premature labor. The question is one which is by no means easy to settle. Here we have to deal with a disease which is certain to prove fatal to the mother before long, and one the progress of which is probably accelerated after labor, while the manipulations necessary to induce delivery may very unfavorably influence the diseased structures. Again, by such a measure we necessarily sacrifice the child, while we are by no means certain that we materially lessen the danger to the mother. The question cannot be settled except on a consideration of each particular case. If we have the opportunity of seeing the patient early in pregnancy, by inducing abortion we may save the mother the dangers of labor at term, possibly of the Cæsarean section, if the obstruction is great. Under such circumstances the operation would, no doubt, be justifiable. If the pregnancy has advanced beyond the sixth or seventh month, unless the amount of malignant deposit be very small indeed, it is probable that the risks of labor would be as great to the mother as at term, and it would then be advisable to give her the advantage of the few months' delay.

Ovarian Tumor.—Cases are occasionally met with in which pregnancy occurs in women who are suffering from ovarian tumor, and their proper management has given rise to considerable discussion. There can be no doubt that cases of this kind left to nature are attended with very dangerous and often fatal consequences, for the abdomen cannot well accommodate at the same time the gravid uterus and the ovarian tumor, both increasing simultaneously. The result is that the tumor is subject to much contusion and pressure, which have sometimes led to the rupture of the cyst and the escape of its contents into the peritoneal cavity, at others to a low form of inflammation, attended with much exhaustion, the death of the patient supervening either before or shortly after delivery. The danger during delivery from the same cause, in the cases which go on to term, is also very great. Of thirteen cases of delivery by the natural powers, which I collected in a paper on "Labor Complicated with Ovarian Tumor,"[1] far more than one-half proved fatal. Another source of danger is twisting of the pedicle, and consequent strangulation of the cyst, of which several instances are recorded. It is obvious, then, that the risks are so manifold that in every case it is advisable to consider whether they can be lessened by surgical treatment. The means at our disposal are either to induce labor prematurely, to treat the tumor by tapping, or to perform ovariotomy. The question has been particularly discussed by Spencer Wells in his works on "Ovariotomy," and by Barnes in his "Obstetric Operations." The former holds that the proper course to pursue is to tap the tumor when there is any chance of its being materially lessened in size by that procedure, but that when it is multilocular, or when its contents are solid, ovariotomy should be performed at as early a period of pregnancy as possible. Barnes, on the other hand, maintains that the safer course is to imitate the means by which nature often meets this complication, and bring on premature labor without interfering with the tumor. He thinks that ovariotomy is out of the question, and that tapping may be insufficient and leave enough of the tumor seriously to interfere with labor. So far as recorded cases go, they unquestionably seem to show that tapping in itself during pregnancy is not more dangerous than at other times, and that ovariotomy may be practised during pregnancy with a fair amount of success. Wells records six cases which were surgically interfered with. In one tapping was performed, and in five ovariotomy; and all of these recovered, the pregnancy going on to term in four, the fifth being combined with the Cæsarean section. On the other hand, five cases were left alone, and either went to term, or spontaneous premature labor supervened; and of these three died. The cases are not sufficiently numerous to settle the question, but they certainly favor the view taken by Wells rather than by Barnes. It is to be observed that, unless we give up all hope of saving the child, and induce abortion at an early period, the risk of induced premature labor, when the pregnancy is sufficiently advanced to hope for a viable child, would almost be as great as that of labor at term; for the question of interference will only have to be considered with regard to large tumors, which would be nearly as much affected by the pressure of a gravid uterus at seven or eight months as by one at term. Small tumors generally escape attention, and are more apt to be impacted before the presenting part in delivery. The success of ovariotomy during pregnancy has certainly been great, and we have to bear in mind that the woman must necessarily be subjected to the risk of the operation sooner or later, so that we cannot judge of the case as one in which even a successful abortion terminates the risk. Even if the operation should put an end to the pregnancy—and there is at least a fair chance that it will not do so—there is no certainty that that would increase the risk of the operation to the mother, while as regards the child we should only then have the same result as if we intentionally produced abortion. On the whole, then, it seems that the best chance to the mother, and certainly the best to the child, is to resort to the apparently heroic practice recommended by Wells. The determination must, however, be to some extent influenced by the skill and experience of the operator. If the medical attendant has not gained that experience which is so essential for a successful ovariotomist, the interests of the mother would be best consulted by the induction of abortion at as early a period as possible. One or other procedure, however, is essential; for, in spite of a few cases in which several successive pregnancies have occurred in women who have had ovarian tumors, the risks are such as not to justify an expectant practice. Should rupture of the cyst occur, there can be no doubt that ovariotomy should at once be resorted to, with the view of removing the lacerated cyst and its extravasated contents.

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[1] Obst. Trans., vol. ix.

Fibroid Tumors.—Pregnancy may occur in a uterus in which there are one or more fibroid tumors. If these are situated low down and in a position likely to obstruct the passage of the fœtus, they may very seriously complicate delivery. When they are situated in the fundus or body of the uterus, they may give rise to risk from hemorrhage, or from inflammation of their own structure. Inasmuch as they are structurally analogous to the uterine walls in which they are situated, they partake of the growth of the uterus during pregnancy, and frequently increase remarkably in size. Cazeaux says, "I have known them in several instances to acquire a size in three or four months which they would not have done in several years in the non-pregnant condition." Conversely, they share in the general involution of the uterus after delivery, and often lessen greatly in size, or even entirely disappear. Of this fact I have elsewhere recorded several curious examples;[1] and many other instances of the complete disappearance of even large numbers have been described by authors whose accuracy of observation cannot be questioned. The *treatment* will vary with the position of the tumor. If it is such as to be certain to obstruct the passage of the child, abortion should be induced as soon as possible. If the tumor is well out of the way, this is not so urgently called for. The principal danger then is that the tumor will impede the post-partum contraction of the uterus, and favor hemorrhage. Even if this should happen, the flooding could be controlled by the usual means, especially by the injection of the perchloride of iron. I have, however, seen several cases in which delivery has taken place under such circumstances without any untoward accident. The danger from inflammation and subsequent extrusion of the fibroid masses would probably be as great after abortion or premature labor as after delivery at term. It seems, therefore, to be the proper rule only to interfere when the tumors are likely to impede delivery, and in other cases to allow the pregnancy to go on, and be prepared to cope with any complications as they arise. The risks of pregnancy should be avoided in every case in which uterine fibroids of any size exist, the patients being advised to lead a celibate life.

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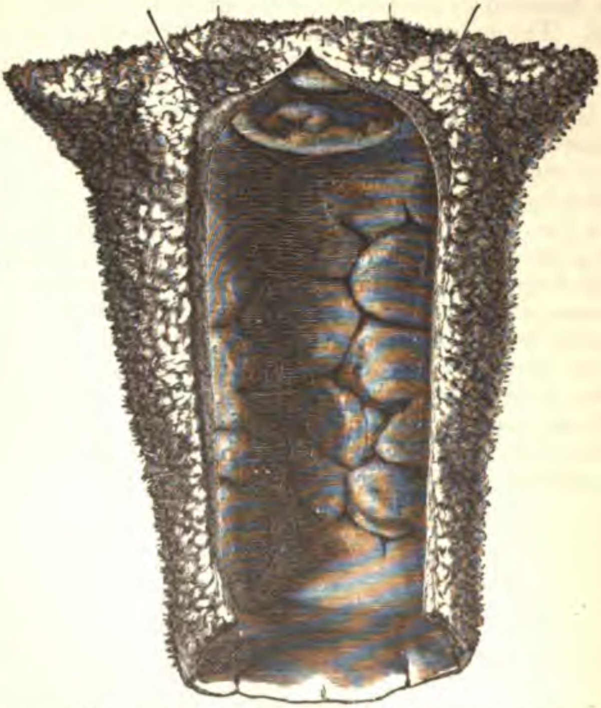
[1] Obst. Trans., vol. v.

CHAPTER IX.

PATHOLOGY OF THE DECIDUA AND OVUM.

COMPARATIVELY little is, unfortunately, known of the pathological changes which occur in the mucous membrane of the uterus during pregnancy. It is probable, however, that they are of much more consequence than is generally believed to be the case; and it is certain that they are one of the most frequent causes of abortion. One of the most generally observed probably depends on endometritis antecedent to conception. When the impregnated ovule reached the uterus, it engrafted itself on the inflamed mucous membrane, which was in an unfit condition for its reception and growth. A not uncommon consequence, under such circumstances, is the laceration of some of the decidual vessels, extravasation of blood between the decidua and the uterine walls, and consequent abortion at an early stage of pregnancy.

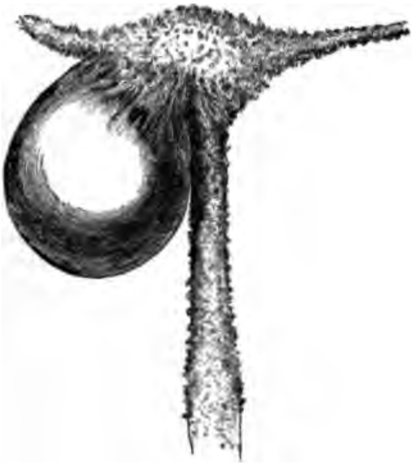
FIG. 78.



HYPERTROPHIED DECIDUA LAID OPEN, WITH THE OVUM ATTACHED TO ITS FUNDAL PORTION.

As this morbid state of the uterine mucous membrane is likely to continue after the abortion is completed, the same history repeats itself on each impregnation, and thus we may have constant early miscarriages produced. It does not necessarily follow, however, that the pregnancy is immediately terminated when this state of things is present. Sometimes a condition of hyperplasia of the decidua is produced, the membrane becomes much thickened and hypertrophied, and the decidual cells are greatly increased in size (Fig. 78). In some instances the internal surface of the decidua becomes studded with rough polypoid growths,[1] depending on proliferation of the interstitial tissue of the mucous membrane. Duncan has found that the hypertrophied decidua is always in a state of fatty degeneration, more advanced in some places than in others.[2] The result of these alterations in the lining membrane of the uterus is frequently to produce dwindling or death of the ovum, which, however, retains its organic connection to the decidua, until, after a lapse of time, the decidua is expelled in the form of a thick triangular fleshy substance, with the atrophied ovum attached to some part of its inner surface. In other cases, in which the hyperplasia of the decidua has advanced to a less extent, the nutrition of the fœtus is not interfered with, and pregnancy may continue to term, the changes in the decidua being recognizable after delivery. Other factors besides endometritis may give rise to similar alterations in the decidua, one of these being, as Virchow maintains, the poison of syphilis. The converse condition, an imperfect development of the decidua, especially of the decidua reflexa, has also been noted as a cause of abortion. The ovum will then hang loosely in the uterine cavity, without the support which the growth of the decidua reflexa around it ought to afford, and its premature expulsion readily follows (Fig. 79).

FIG. 79.



IMPERFECTLY DEVELOPED DECIDUA VERA, WITH THE OVUM.

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[1] Virchow's Archiv für Path., 1861.

[2] Researches in Obstetrics, p. 293.

The peculiar condition known as *hydrorrhœa gravidarum* most probably depends on some obscure morbid state of the uterine mucous membrane. By this is meant a discharge of clear watery fluid at intervals during pregnancy. It may happen at any period of gestation, but it is most commonly met with in the latter months. It may commence with a mere dribbling, or there may be a sudden and copious discharge of fluid. Afterwards the watery fluid, which is generally of a pale yellowish color, and transparent, like the liquor amnii, may continue to escape at intervals for many weeks, and sometimes in very great abundance, so as to saturate the patient's clothes. Very frequently it is expelled in gushes, and at night, when the patient is lying quietly in bed; its escape is then probably due to uterine contraction.

Many theories have been held as to the cause of this occurrence. By some it is attributed to the rupture of a cyst placed between the ovum and the uterine walls; Baudelocque referred it to a transudation of the liquor amnii through the membranes; while Burgess and Dubois believed it to depend on a laceration of the membranes at a distance from the os uteri. Mattei more recently has attributed it to the existence of a sac between the chorion and the amnion. It may be that in some instances a single discharge of fluid may come from one of the two last-mentioned causes. But if it be continuous and repeated, another source must be sought for. Hegar[1] maintains that it is the result of abundant secretion from the glands of the mucous membrane, which accumulates between the decidua and chorion and escapes through the os uteri. If this occurs, the decidua is probably in an hypertrophied and otherwise morbid state. Hydrorrhœa is chiefly of interest from the error of diagnosis it is likely to give rise to; for on being summoned to a case in which watery discharge had occurred for the first time, we are naturally apt to suppose that the membranes have ruptured, and that labor is imminent. Nor is there any very certain means of deciding if this be so. In hydrorrhœa, however, we find that pains are absent, the os uteri unopened, and ballottement may be made out. Even if the membranes be ruptured, there will be no indication for interference unless labor has actually commenced; and the repetition of the discharge, and the continuance of the pregnancy, will soon clear up the diagnosis. Hydrorrhœa, although apt to alarm the patient, need not give rise to any anxiety. The pregnancy generally progresses favorably to the full period; although, in exceptional cases, premature labor may supervene. No treatment is necessary, nor is there any that could have the least effect in controlling the discharge.

The only important disease of the chorion, with which we are acquainted, is the well-known condition which is variously described as *uterine hydatids, cystic disease of the ovum, hydatiform degeneration of the chorion*, or *vesicular mole*. The name of uterine hydatids was long given to it on the supposition that the grape-like vesicles which characterize the disease were true hydatids, similar to those which develop themselves in the liver and other structures. This idea has long been exploded, and it is now known as a certainty that the disease originates in the villi of the chorion. The precise mode and the causes of its production, are, however, not yet satisfactorily settled. The disease is characterized by the existence in the cavity of the uterus of a large number of translucent vesicles, containing a clear limpid fluid, which has been found on analysis to bear a close resemblance to the liquor amnii (Heller). These small bladder-like bodies, which vary in size from that of a millet-seed to an acorn, are often described as resembling a bunch of grapes or currants. On more minute examination, however, they are found not to be each attached to independent pedicles as is the case in a bunch of grapes, but some of them grow from other vesicles, while others have distinct pedicles attached to the surface of the chorion, the pedicles themselves sometimes being distended by fluid (Fig. 80). This peculiar arrangement of the vesicles is explained by their mode of growth.

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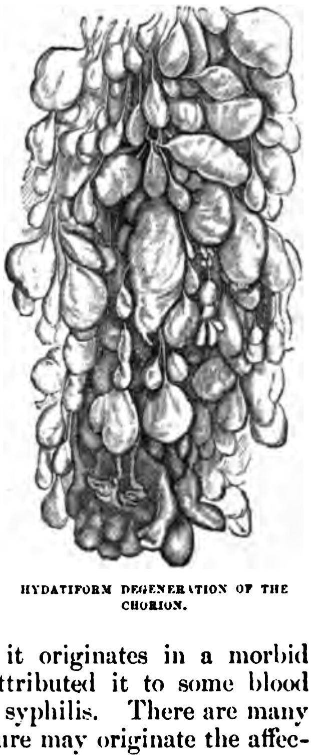
[1] Monat. f. Geburt, 1863.

FIG. 80.



HYDATIFORM DEGENERATION OF THE CHORION.

There has been considerable discussion as to the etiology of this disease. By some it is supposed always to follow death of the fœtus; and the whole developmental energy being expended on the chorion, which retains its attachment to the decidua, the result is its abnormal growth and cystic degeneration. This is the view maintained by Gierse and Graily Hewitt, and it is favored by the undoubted fact that in almost all cases the fœtus has entirely disappeared, and by the occasional occurrence of cases of twin conceptions in which one chorion has degenerated, the other remaining healthy until term. On the other hand, it is maintained that the starting-point is connected with the maternal organism. Virchow thinks it originates in a morbid state of the decidua; while others have attributed it to some blood dyscrasia on the part of the mother, such as syphilis. There are many reasons for believing that causes of this nature may originate the affection. Thus, it is often found to occur more than once in the same person; and alterations of a similar kind, although limited in extent, are not unfrequently found in connection with the placenta and membranes of living children. On this theory the death of the fœtus is secondary, the consequence of impaired nutrition from the morbid state of the chorion. The probability is that both views may be right, the disease sometimes following the death of the embryo, and at others being the result of obscure maternal causes.

Its Pathology.—The degeneration of the chorion villi generally commences at an early period of pregnancy, before the placenta has commenced to form. In that case the entire superficies of the chorion becomes affected. The disease, however, may not begin until after the greater part of the chorion villi have atrophied, and then it is limited to the placenta. The epithelium of the villi appears to be the part first affected, and the whole interior of the diseased villus becomes filled with cells. The connective tissue of the villus undergoes a remarkable proliferation, and collects in masses at individual spots, the remainder of the villus being unaffected. By the growth of these elements the villus becomes distended, and many of the cells liquefy, the intercellular fluid, thus produced, widely separating the connective tissue, so as to form a network in the interior of the villus.[1] Thus are formed the peculiar grape-like bodies which characterize the disease. When once the degeneration has commenced, the diseased tissue has a remarkable power of increase, so that it sometimes forms a mass as large as a child's head, and several pounds in weight.

The nutrition of the altered chorion is maintained by its connection with the decidua, which is also generally diseased and hypertrophied. Sometimes the adhesion of the mass to the uterine walls is very firm, and may interfere with its expulsion; while in a few rare cases it has been found that the villi have forced their way into the substance of the uterus, chiefly through the uterine sinuses, and thus caused atrophy and thinning of its muscular structure. Cases of this kind are related by Voltman, Jarolz, Waldeyer,[2] and Barnes, and it is obvious that the intimate adhesion thus effected must seriously add to the gravity of the prognosis.

Taking this view of the etiology of this disease, it is obvious that it is essentially connected with pregnancy, and that there is no valid ground for maintaining, as has sometimes been done, that it may occur independently of conception. It is just possible, however, that true entozoa may form in the substance of the uterus, which being expelled per vaginam might be taken for cystic disease, and thus give rise to groundless suspicions as to the patient's chastity. Hewitt has related one case in which true hydatids, originally formed in the liver, had extended to the peritoneum, and were about to burst through the vagina at the time of death. This occurred in an unmarried woman. One or two other examples of true hydatids forming in the substance of the uterus are also recorded. A very interesting case is also related by Hewitt,[3] in which undoubted acephalocysts were expelled from the uterus of a patient who ultimately recovered. A careful examination of the cyst and its contents would show their true nature, as the echinococci heads, with their characteristic hooklets, would be discoverable on microscopic examination.

It is also possible that unfounded suspicions might arise from the fact of a patient expelling a mass of hydatids long after impregnation. In the case of a widow, or woman living apart from her husband, serious mistakes might thus be made. This has been specially pointed out by McClintock,[4] who says, "Hydatids may be retained in utero for many months or years, or a portion only may be expelled, and the residue may throw out a fresh crop of vesicles, to be discharged on a future occasion."

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[1] Braxton Hicks, Guy's Hospital Reports, vol. ii., Third Series, p. 188.

[2] Virchow's Archiv, vol. xliv. p. 88.

[3] Obst. Trans., vol. xii.

[4] McClintock's Diseases of Women, p. 398.

The symptoms of cystic disease of the ovum are by no means well marked. At first there is nothing to point to the existence of any morbid condition, but as pregnancy advances its ordinary course is interfered with. There is more general disturbance of the health than there ought to be, and the reflex irritations, such as vomiting, may be unusually developed. The first physical sign remarked is rapid increase of the uterine tumor, which soon does not correspond in size to the supposed period of pregnancy. Thus, at the third month the uterus may be found to reach up to, or beyond, the umbilicus. About this time there generally are more or less profuse watery and sanguineous discharges, which have been described as resembling currant-juice. They no doubt depend on the breaking down and expulsion of the cysts, caused by painless uterine contractions. They are sometimes excessive in amount, recur with great frequency, and often reduce the patient extremely. Portions of cysts may now generally be found mingled with the discharge, and sometimes large masses of them are expelled from time to time. Indeed, the discovery of portions of cysts is the only certain diagnostic sign of the disease. Vaginal examination, before the os has dilated, will give no information, except the absence of ballottement. An unusual hardness or density of the uterus, described by Leishman, who attributes much importance to it, as "a peculiar doughy, boggy feeling," has been pointed out by several writers. The contour of the uterine tumor, moreover, is often irregular. In addition, we, of course, fail to discover the usual auscultatory signs of pregnancy. All this may aid in diagnosis, but nothing, except the presence of cysts in the watery bloody discharge, will enable us to pronounce with certainty as to the nature of the disease.

Treatment.—As soon as the diagnosis is established, the indications of treatment are obvious. The sooner the uterus is cleared of its contents, the better. Ergot may be given with advantage to favor uterine contraction and the expulsion of the diseased ovum. Should this fail, more especially if the hemorrhage is great, the fingers, or the whole hand, must be introduced into the uterus, and as much as possible of the mass removed. As the os is likely to be closed, its preliminary dilatation by sponge or laminaria tents, or by a Barnes' bag, if it is already opened to some extent, will in most cases be required. If chloroform be then administered, the remaining steps of the operation will be easy. On account of the occasional firm adhesion of the cystic mass to the uterus, too energetic attempts at complete separation should be avoided. Any severe hemorrhage after the operation can be controlled by swabbing out the uterine cavity with the perchloride of iron solution.

Under the name of *Myxoma fibrosum* a more rare degeneration of the chorion has been described by Virchow and Hildebrandt,[1] characterized, not by vesicular, but fibroid degeneration of the connective tissue of the chorion. This is, however, too little understood to require further observation.

The *pathology of the placenta* has of late years attracted much attention, and has an important practical bearing in consequence of its effects on the child.

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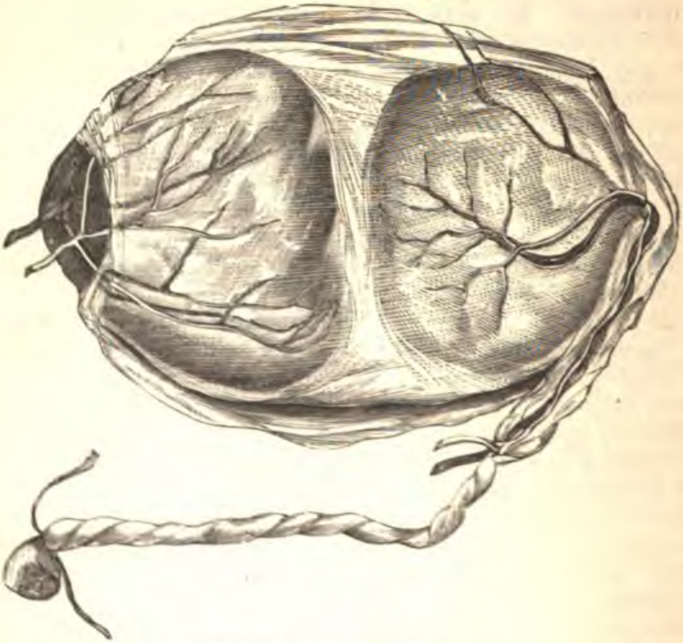
[1] Monat. f. Geburt, May, 1865.

Placentæ vary considerably in shape. They may be crescentic, or spread over a considerable surface, in consequence of the chorion villi entering into communication with a larger portion of the decidua than usual (*Placenta membranacea*). Such forms, however, are merely of scientific interest. The only anomaly of shape of any practical importance is the formation of what have been called *placentæ succenturiæ*. These consist of one or more separate masses of placental tissue, produced by the development of isolated patches of chorion villi. Hohl believes that they always form exactly at the junction of the anterior and posterior walls of the uterus, which in early pregnancy is a mere line. As the uterus expands, the portions of placenta on each side of this become separated from each other. They are only of consequence from the possibility of their remaining unnoticed in the uterus after delivery, and giving rise to secondary post-partum hemorrhage. The rare form of double placenta with a single cord, figured in the accompanying woodcut (Fig. 81), was probably formed in this way, and the supplementary portion, in such a case, might readily escape notice.

FIG. 81.



DOUBLE PLACENTA, WITH SINGLE CORD.

The placenta may also vary in dimensions. Sometimes it is of excessive size, generally when the child is unusually big; but not unfrequently in connection with hydramnios, the child being dead and shrivelled. In other cases it is remarkably small, or at least appears to be so. If, however, the child be healthy, this is probably of no pathological importance, as its smallness may be more apparent than real, depending on its vessels not being distended with blood. When true atrophy of the placenta exists, the vitality of the fœtus may be seriously interfered with. This condition may depend either on a morbid state of the chorion villi, or of the decidua in which they are implanted.[1] The latter is the more common of the two; and it generally consists in hyperplasia of the connective tissue of the decidua, which presses on the villi and vessels and gives rise to general or local atrophy. This change is similar in its nature to that observed in cirrhosis of the liver, and certain forms of Bright's disease. It has generally been ascribed to inflammatory changes, and, under the name of *placentitis*, has been described by many authors, and has been considered to be a common disease. To it are attributed many of the morbid alterations which are commonly observed in placentæ, such as hepatization, circumscribed purulent deposits, and adhesions to the uterine walls. Many modern pathologists have doubted whether these changes are in any proper sense inflammatory. Whittaker observes on this point, "The disposition to reject placentitis altogether increases in modern times. Indeed, it is impossible to conceive of inflammation on the modern theory (Cohnheim) of that process, since there are no capillaries, in the maternal portion at least, through whose walls a 'migration' might occur, and there are no nerves to regulate the contractility of the vessel-walls in the entire structure." Robin explains the occurrence of the various pathological changes above alluded to by saying that, "What has been taken for inflammation of the placenta is nothing less than a condition of transformation of blood-clots at various periods. What has been regarded as pus is only fibrine in the course of disorganization, and in those cases where true pus has been found the pus did not come from the placenta, but from an inflammation of the tissue of the uterine vessels and an accidental deposition in the tissue of the placenta." The partial extravasations of blood here alluded to are of very common occurrence, and they are found in all parts of the organ, in its substance, on its decidual surface, or immediately below the amnion, in which latter situation they serve as points of origin for the cysts that are there often observed. The fibrine thus deposited undergoes retrograde metamorphosis as in other parts of the body; it becomes decolorized, it undergoes fatty degeneration, or it becomes changed into calcareous masses; and in this way, it is supposed, may be explained the various pathological changes which are so commonly observed. The amount of retrograde metamorphosis, and the precise appearance presented, will, of course, depend on the time that has elapsed since the blood extravasations took place.

Fatty degeneration of the placenta, and its influence on the nutrition of the fœtus, have been specially studied in this country by Barnes and Druitt. Yellowish masses of varying size are very commonly met with in placentæ, and these are found to consist, in great part, of molecular fat, mixed with a fine network of fibrous tissue. The true fatty degeneration, however, specially affects the chorion villi (Fig. 82). On microscopic examination they are found to be altered and misshaped in their contour, and to be loaded with fine granular fat globules. Similar changes are observed in the cells of the decidua. The influence on the fœtus will, of course, depend on the extent the functions of the villi are interfered with. The probable cause of this degeneration is, no doubt, some obscure alteration in the nutrition of the tissue, depending on the state of the mother's health. Barnes believes that syphilis has much influence in its production. Druitt has pointed out that some amount of fatty degeneration is always present in a mature placenta, and is probably connected with the physiological separation of the organ; and Goodell has more recently suggested that an unusual amount of this change may be merely an anticipation of the natural termination of the life of the placenta.[1]

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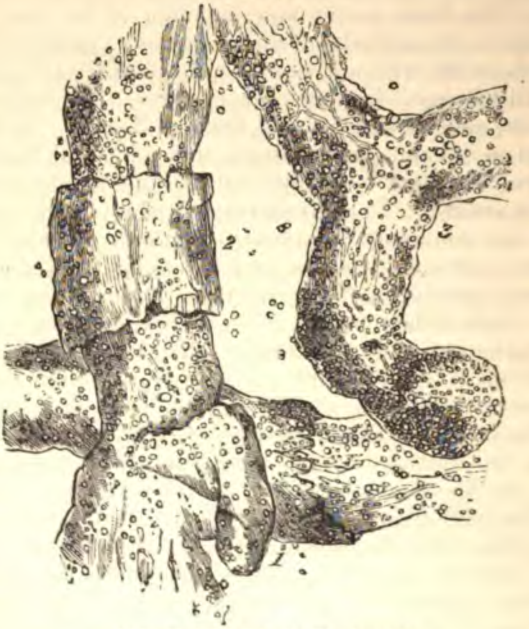
[1] Whittaker's Amer. Jour. of Obst, vol. iii. p. 229.

FIG. 82.



FATTY DEGENERATION OF THE PLACENTA.

Other morbid states of the placenta, of greater rarity, are occasionally met with, as an œdematous infiltration of its tissue, always occurring, according to Lange, in cases of hydramnios; pigmentary and calcareous deposits; and tumors of various kinds: but these require only a passing mention.

Pathology of the Umbilical Cord.—The umbilical cord may be of excessive length, varying from 18 to 20 inches, which is its average measurement, up to 50 or 60 inches; and a case is recorded in which it even reached the extraordinary length of 9 feet. If unusually long, it may be twisted round the limbs or neck of the child, and the latter position may, in exceptional instances, prove injurious during labor.

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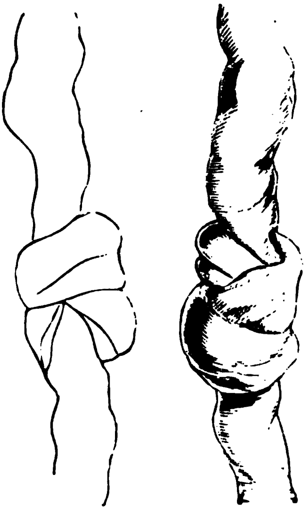
[1] American Journ. of Obst., vol. ii. p. 585.

Some authors refer cases of spontaneous amputation of fœtal limbs in utero to constrictions by the umbilical cord; but this accident more probably is produced by filamentous adnexa of the amnion. Knots in the cord are not uncommon, and they result from the fœtus, in its movements, passing through a loop of the cord (Fig. 83). If there is an average amount of Wharton's jelly in the cord, the vessels are protected from pressure, and no bad effects follow.

FIG. 83.



KNOTS ON THE UMBILICAL CORD.

Extreme torsion of the cord, an exaggeration of the spiral twists generally observed, may prove injurious, and even fatal, to the child, by obstructing the circulation in the vessels. Spaeth mentions three cases in which this caused the death of the fœtus, the cord being twisted until it was reduced to the thickness of a thread.

Anomalies in the distribution of the vessels of the cord are of common occurrence. The cord may be attached to the edge, instead of to the centre, of the placenta (*battledore placenta*). It may break up into its component parts before reaching the placenta, the vessels running through the membranes; and if, in such a case, traction on the cord be made, the separate vessels may lacerate, and the cord become detached. There may be two veins and one artery, or only one vein and one artery, or there may be two separate cords to one placenta. These, and other anomalies that might be mentioned, are, however, of little practical importance.

Pathology of the Amnion.—The principal pathological condition of the amnion with which we are acquainted is that which is associated with excessive secretion of liquor amnii, and generally known under the name of *hydramnios*. Its precise cause is still a matter of doubt. By some it is referred to inflammation of the amnion itself; at other times it is apparently connected with some morbid state of the decidua, which may be found diseased and hypertrophied. The fœtus is very often dead and shrivelled, and the placenta enlarged and œdematous. It does not necessarily follow, however, that hydramnios causes the death of the child. Out of thirty-three cases McClintock found that nine children were born dead;[1] and of the nineteen born alive, ten died within a few hours, the remainder survived. There does not appear to be any marked relation between the state of the mother's health and the occurrence of this disease; and it is certainly not necessarily present when the mother is suffering from dropsical effusions in other parts of the body. The theory that the disease is of purely local origin is favored by the fact that when hydramnios occurs in twin pregnancy, one ovum only is generally affected. Its effects, as regards the mother, are chiefly mechanical. It rarely begins to show itself before the fifth or sixth month of pregnancy, but when once it has commenced it rapidly produces a feeling of discomfort and enlargement, altogether beyond that which should exist at the period of pregnancy which has been reached. In advanced stages the distress produced is often very great, the enlarged uterus pressing upon the diaphragm and producing much embarrassment of respiration. Premature expulsion of the fœtus very often supervenes. Four out of McClintock's patients died after labor, showing that the maternal mortality is high, a result which he refers to the debilitated state of the women who were the subjects of the disease.

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[1] Diseases of Women, p. 383.

The *diagnosis* is not, as a rule, difficult. It has to be distinguished from ascitic distension of the abdomen, and from enlargement of the uterus from twin pregnancy. The former will be recognized by the superficial position of the fluid; by the difficulty of feeling the contour of the uterus, which is obscured by the surrounding fluid; and by the coexistence of dropsical effusions in other parts of the body. The latter may be difficult, and even impossible, to diagnose from it; generally, however, in hydramnios the uterine tumor is more distinctly tense or fluctuating; the fœtal limbs cannot be felt on palpation; and the lower segment of the uterus, per vaginam, is unusually distended, the presenting part not being appreciable.

During labor an excessive amount of liquor amnii is often a cause of deficient uterine action and delay, the pains being feeble and ineffective. This, of course, tells chiefly in the first stage, which is often much prolonged, unless the membranes are punctured early and the superabundant fluid allowed to escape.

Treatment.—No treatment is known to have any effect on the disease. If the discomfort and distension are very great, it may be absolutely necessary to puncture the membranes and allow the water to escape. This inevitably brings on labor. If the pregnancy be not sufficiently advanced to give hope for the birth of a living child, we would not, of course, resort to this expedient unless the mother's health was seriously imperilled. It is possible that in such cases removal of a portion of the fluid, and relief of the patient, might be effected by inserting the minute needle of an aspirator through the os, and removing a certain quantity of the liquor amnii by aspiration, without inducing the labor. I have never had an opportunity of trying this expedient; but it seems a possibility.

A *defective amount of liquor amnii* is said to favor certain malformations, by allowing the uterus to compress the fœtus unduly. It certainly occasionally gives rise to adhesion between the fœtus and the membranes, and to the formation of amniotic bands which are capable of producing certain fœtal deformities (p. 214).

The liquor amnii itself varies much in appearance. It is sometimes thick and treacly, instead of limpid, and it may be offensive in odor. The cause of these variations is not well understood.

Pathology of the Fœtus.—There is abundant evidence that the fœtus in utero is subject to many diseases, some of which cause its death, and others leave distinct traces of their existence, although not proving fatal.

The subject is of great importance, and is well worthy of study. There is still much to be done in this direction, which may yet lead to important practical results. I can, however, do little more than enumerate some of the principal affections which have been observed.

Blood Diseases transmitted through the Mother.—It is a well-established fact that the various eruptive fevers from which the mother may suffer are capable of being communicated to the fœtus in utero. When the mother is attacked with confluent small-pox, she almost always aborts, but not necessarily so when it is discrete or modified. In such cases it has often happened that the fœtus has been born with evident marks of small-pox. Cases are on record which prove that the fœtus was attacked subsequently to the mother. Thus, a mother attacked with small-pox has miscarried, and has given birth to a living child showing no trace of the disease, which, however, showed itself in two or three days; proving that it had been contracted, and had run through its usual period of incubation, when the fœtus was still in utero. It does not follow, however, that the fœtus is affected, as Serres has collected twenty-two cases in which women suffering from small-pox gave birth to children who had not contracted the disease. It has been supposed that in such cases the child is protected from small-pox, though it has shown no symptom of having had the disease. Tarnier, however, cites two instances in which such children had small-pox two years after birth. Madge and Simpson record cases in which vaccination performed on the mother during pregnancy protected the fœtus, on whom all subsequent attempts at vaccination failed. There is evidence also to prove that the disease may be transmitted to the fœtus through a mother who is herself unsusceptible of contagion; the child having been covered with small-pox eruption, the mother being quite free from it. It is probable, reasoning from analogy, that the same facts as have been observed with regard to small-pox hold true with reference to other zymotic diseases, such as scarlet fever and measles, although there is not sufficient evidence to justify a positive assertion to that effect.

Amongst other maternal diseases, malarious and lead poisoning are known to affect the fœtus in utero. Dr. Stokes relates cases in which the mother suffered from tertian ague, the child having also attacks, as evidenced by its convulsive movements, appreciable by the mother, which took place at the regular intervals, but at a different time from the mother's paroxysms. In other cases the febrile paroxysm comes on at the same time in the fœtus as in the mother; and the fact has been verified by the observation that the paroxysms continued to recur simultaneously after delivery. The fœtus has also been born with distinct malarious enlargement of the spleen. From the frequency with which largely hypertrophied spleens are seen in mere infants in malarious districts, I imagine that the intra-uterine disease must be common. I have frequently observed this fact in India, although of course without any possibility of ascertaining if the mothers had suffered from intermittent fever during pregnancy. Lead-poisoning is also known to have a most prejudicial effect on the fœtus, and frequently to lead to abortion. M. Paul has collected 81 cases[1] in which it caused the death of the fœtus, in some not until after birth, and occasionally it seems to have affected the fœtus even when the mother escaped.

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[1] Arch. Gén. de Méd., 1860.

Syphilis.—Of all blood dyscrasiæ transmitted to the fœtus, the most important is syphilis. Its influence in producing repeated abortion has been elsewhere described. It may unquestionably be transmitted to the fœtus without producing abortion, and at term the mother may be either delivered of a living child, bearing evident traces of the disease; of a dead child similarly affected; or of an apparently healthy child in whom the disease develops itself after the lapse of a month or two. These varying effects probably depend on the intensity of the poison. The disease is no doubt generally transmitted through the mother, and, if she be affected at the time of conception, the infection of the fœtus seems certain. If, however, she contract the disease at an advanced period of pregnancy, the child may entirely escape. Ricord even believes that syphilis contracted after the sixth month of pregnancy never affects the child. The father alone may unquestionably transmit the disease to the ovum, but less frequently than the mother; and Hutchinson has recorded cases to show that the mother may become secondarily infected through the diseased fœtus. The evidences of syphilitic taint in a living or dead child are sufficiently characteristic. The child is generally puny and ill developed. An eruption of pemphigus is common, either fully-developed bullæ, or their early stage, when they form circular copper-colored patches. This eruption is always most marked on the hands and feet, and a child born with such an eruption may be certainly considered syphilitic. On post-mortem examination the most usual signs are small patches of suppuration in the thymus, similar localized suppurations in the tissues of the lungs, indurated yellowish patches in the liver, and peritonitis, the importance of which in causing the death of syphilitic children has been specially dwelt on by Simpson.[1]

Inflammatory Diseases.—The most important of the inflammatory diseases affecting the fœtus is peritonitis. Simpson has shown that traces of it are very frequently met with, and that it is not necessarily always syphilitic. Sometimes it has been observed when the mother has been in bad health during pregnancy, and at others it seems to have resulted from some morbid condition of the fœtal viscera. Pleurisy, with effusion, is another inflammatory affection which has been noticed.

The dropsical affections most generally met with are ascites and hydrocephalus, which may both have the effect of impeding delivery. Of these, hydrocephalus is the most common, and may give rise to much difficulty in labor. Its causes are uncertain, but it probably depends on some altered state of the mother's health, as it is apt to recur in several successive pregnancies, and it is not unfrequently associated with an imperfectly developed vertebral column and spina bifida. The fluid collects in the ventricles, which it greatly distends, and these then produce expansion and thinning of the cranium, the bones of which are widely separated from each other at the sutures, which are prominent and fluctuating. In a few cases internal hydrocephalus may be complicated, and the diagnosis in labor consequently obscured, by the co-existence of what has been called "external hydrocephalus." This consists of a collection of fluid between the skull and the scalp, which may be either formed there originally, or may collect from a rupture of one of the sutures or fontanelles during labor, through which the intra-cranial fluid escapes.

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[1] Obst. Works, vol. i. p. 117.

Ascites is generally associated with hydramnios, and sometimes with hydro-thorax, or other dropsical effusions. It is a rare affection, and, according to Depaul,[1] extreme distension of the bladder is not unfrequently mistaken for it.

Tumors of different kinds may be met with in various parts of the child's body, which sometimes grow to a great size and impede delivery. Tarnier records cases of meningocele larger than the child's head, and large cystic growths have been observed attached to the nates, pectoral region, or other parts of the body. Cancerous tumors of considerable size, either external, or of the viscera, have also been met with. Other fœtal tumors may be produced by congenital deformities, such as projection of the liver, or other abdominal viscera, through a deficiency of the abdominal wall; or by spina bifida, from imperfectly developed spine. The amount of dystocia produced by such causes will, of course, vary much in proportion to the size, consistency, and accessibility of the tumor.

Wounds and Injuries of the Fœtus.—Accidents of serious gravity to the fœtus may happen from violence to which the mother has been subjected, such as falls or blows, without necessarily interfering with gestation. Many curious examples of this kind are on record. Thus, a child has been born presenting a severe lacerated wound, extending the whole length of the spine, where both the skin and the muscles had been torn, and which seems to have resulted from the mother having fallen in the last month of pregnancy. Similar lacerations and contusions have been observed in other parts of the body, the wounds being in various stages of cicatrization, corresponding to the lapse of time since the accident had occurred. Intra-uterine fractures are not rare, apparently arising from similar causes. In some of these cases the broken ends of the bones had united, but, from want of accurate apposition, at an acute angle, so as to give rise to much subsequent deformity. Chaussier[2] records two cases in which there were many fractures in the same child, in one 113, and in another 42, which were in different stages of repair. He attributes this curious occurrence to some congenital defect in the nutrition of the bones, possibly allied to mollities ossium.

Intra-uterine amputations of fœtal limbs have not unfrequently been observed. Children are occasionally born with one extremity more or less completely absent, and cases are known in which the whole four extremities were wanting (Fig. 84). The mode in which these malformations are produced has given rise to much discussion. At one time it was supposed that the deficiency of the limb was due to gangrene of the extremity, and subsequent separation of the sphacelated parts. Reuss, who has studied the whole subject very minutely,[3] considers gangrene in the enclosed cavity of the ovum to be an impossibility,

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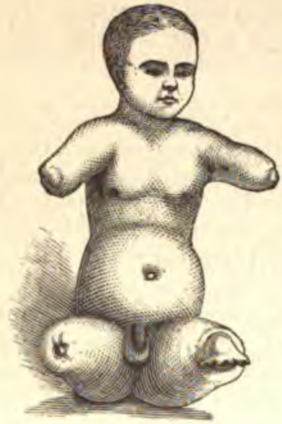
[1] Tarnier's Cazeaux, p. 855.

[2] Gazette Hebdom., 1860.

[3] Scanzoni's Beiträge, 1869.

Fig 84.



INTRA-UTERINE AMPUTATION OF BOTH ARMS AND LEGS.

for that change cannot occur unless there is access of oxygen to the affected part, and when portions of the separated extremity are found in utero, as is often the case, they show evidences of maceration, but not of decomposition. The general belief is that these intra-uterine amputations depend on constriction of the limb by folds or bands of the amnion—most often met with when the liquor amnii is deficient in quantity—which obstruct the circulation, and thus give rise to atrophy of the part below the constriction. It has been supposed that the umbilical cord might, by encircling the limb, produce a like result. It appears doubtful, however, whether this cause is sufficient to produce complete separation of the limb, as any great amount of constriction would interfere with the circulation through the cord. Sometimes, when intra-uterine amputation occurs, the separated portion of the limb is found lying loose in the amniotic cavity, and is expelled after the child. Cases of this kind have been recorded by Martin, Chaussier, and Watkinson. More often no trace of the separated extremity can be found. The explanation probably depends upon the period of utero-gestation at which amputation took place. If it occurred at a very early period of pregnancy, before the third month, the detached portion would be minute and soft, and would easily disappear by solution. If at a later period, this could hardly happen, and the detached portion would remain in utero. In cases of the latter kind, cicatrization of the stump has often been observed to be incomplete. Simpson pointed out the occasional existence of rudimentary fingers or toes on the stump of an amputated limb, such as are seen on the thighs in Fig. 84. These he attributed to an abortive reproduction of the separated extremity, analogous to what is observed in some of the lower animals. This explanation has been, however, contested with much show of reason. Martin believes that the reproduction is only apparent, and that the rudimentary extremities are in reality instances of arrested development. The constricting agents interfered with the circulation sufficiently to arrest the growth of the limb below the site of constriction, but not sufficiently to effect complete separation. If constriction occurred at a very early stage of development, an appearance similar to that observed by Simpson would be produced. It does not follow, however, that all cases of absence of limbs depend on intra-uterine amputations. In some cases they would appear to be the result of a spontaneous arrest of development, or of congenital monstrosity. Mr. Scott relates a case in which a distinct hereditary tendency was evident, and here the deformity certainly could not have resulted from the constriction of amniotic bands. In this family the grandfather had both forearms wanting, with rudimentary fingers

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[1] Obst. Trans., vol. xiii. p. 94.

attached; the next generation escaped; but the grandchild had a deformity precisely similar to the grandfather.

Death of Fœtus.—When, from any cause, the fœtus has died during pregnancy, it may either be soon expelled, or retained in utero for a longer or shorter time, or even to the full period. The changes observed in such fœtuses vary considerably according to the age of the fœtus at the time of death, or the time that it has been retained in utero. If it dies at an early period, when the tissues are very soft, it may entirely dissolve in the liquor amnii, and no trace of it may be found when the membranes are expelled. Or it may shrivel or mummify; and if this happen in a twin pregnancy, as sometimes occurs, the growing fœtus may compress and flatten the dead one against the uterine wall.

At a later period of pregnancy a dead fœtus undergoes changes ascribed to putrefaction, but which produce appearances different from those of decomposition in animal textures exposed to the atmosphere. There is no offensive smell, as in ordinary decay. The tissues are all softened and flaccid. The more manifest changes are in the skin, the epidermis of which is separated from the cutis vera, which has a deep reddish color. This is especially apparent on the abdomen, which is flaccid, and hollow in the centre. The internal organs are much altered. The brain is diffluent and pulpy, and the cranial bones loose within the scalp. The structures of the muscles and viscera are in various stages of transformation, many having undergone fatty changes and containing crystals of margarin and cholesterin. The extent to which these changes occur depends, to a great extent, on the length of time the fœtus has been dead, but they do not admit of our estimating with any degree of accuracy what that time has been.

Diagnosis.—The symptoms and diagnosis of the death of the fœtus may here be considered. They are, unfortunately, not very reliable. The cessation of the fœtal movements cannot be depended on, as they are frequently unfelt for days or weeks, when the child is alive and well. Sometimes, however, the death of the fœtus is preceded by its irregular and tumultuous movements, and, in women who have been delivered of several dead children in succession, this sensation may guide us in our diagnosis. This suspicion may be confirmed by auscultation. The mere fact that we are unable, at any given time, to hear the fœtal heart will not justify an opinion that the fœtus is dead. If, however, the fœtal heart has been distinctly heard, and after one or two careful examinations, repeated at separate times, it cannot again be made out, the probability of the child being dead may be assumed. Certain changes in the mother's health have been noted in connection with the death of the fœtus, such as depression and lowness of spirits, a feeling of coldness and weight about the lower parts of the abdomen, paleness of the face, a livid circle round the eyes, irregular shiverings and feverishness, shrinking of the breasts, and diminution in the size of the abdominal tumor. All these, however, are too indefinite to justify a positive diagnosis, and they are not unfrequently altogether absent. At most they can do no more than cause a suspicion as to what has happened.

CHAPTER X.

ABORTION AND PREMATURE LABOR.

THE premature expulsion of the fœtus is an event of great frequency. The number of fœtal lives thus lost is enormous. There are few multiparæ who have not aborted at one time or other of their lives. Hegar estimates that about one abortion occurs to every eight or ten deliveries at term. Whitehead has calculated that at least 90 per cent. of married women who lived to the change of life had been the subject of abortion. The influence of this accident on the future health of the mother is also of great importance. It rarely, indeed, proves directly fatal, but it often produces great debility from the profuse loss of blood accompanying it; and it is one of the most prolific causes of uterine disease in after-life, possibly because women are apt to be more careless during convalescence than after delivery, and the proper involution of the uterus is thus more frequently interfered with.

A not uncommon division of the subject is into *abortion*, *miscarriage*, and *premature labor*, the first name being applied to expulsion of the ovum before the end of the fourth month of utero-gestation; miscarriage to expulsion from the end of the fourth to the end of the sixth month; and premature labor to expulsion from the end of the sixth month to the term of pregnancy. This is, however, a needless and confusing subdivision, which leads to no practical result. It suffices to apply the term abortion or miscarriage indiscriminately to all cases in which pregnancy is terminated before the fœtus has arrived at a viable age, and premature labor to those in which there is a possibility of its survival. There may be said to be little or no hope of a fœtus living before the twenty-eighth week or seventh lunar month, and that is, therefore, generally fixed on as the limit between premature labor and abortion. The rule is, however, not without an occasional, although very rare, exception. Dr. Keiller, of Edinburgh, has recorded an instance in which a fœtus was born alive at the fourth month, nine days after the mother had experienced the sensation of quickening. I myself recently attended a lady who miscarried in the fifth month of pregnancy, the child being born alive, and living for three hours. Several cases are on record in which after delivery at the sixth month the child survived and was eventually reared. The possibility of the birth of a living child under such circumstances should be recognized, as it may give rise to legal questions of importance; but the exceptions to the ordinary rule are so rare that they need not interfere with the division of the subject usually made.

Multiparæ abort far more frequently than primiparæ. This is contrary to the statement in many obstetrical [illegible] Thus, Tyler Smith says, "there seems to be a greater danger of this accident in the first pregnancy." Schroeder,[1] however, states that twenty-three multiparæ abort to three primiparæ; and Dr. Whitehead, of Manchester, who has particularly studied the subject, believes that abortion is more apt to occur after the third and fourth pregnancies, especially when these take place towards the time for the cessation of menstruation.

There can be no doubt that women who have aborted more than once are peculiarly liable to a recurrence of the accident. This can generally be traced to the existence of some predisposing cause which persists through several pregnancies, as, for example, a syphilitic taint, a uterine flexion, or a morbid state of the lining membrane of the uterus. It is probable, however, that in many women a recurrence of the accident induces a habit of abortion, or, perhaps it might be more accurate to say, a peculiar irritable condition of the uterus, which renders the continuance of pregnancy a matter of difficulty, independently of any recognizable organic cause.

The frequency of abortion varies much at different periods of pregnancy; and it occurs much more often in the early months, because of the comparatively slight connection then existing between the chorion and the decidua. At a very early period of pregnancy the ovum is cast off with such facility, and is of such minute size, that the fact of abortion having occurred passes unrecognized. Very many cases, in which the patient goes one or two weeks over her time, and then has what is supposed to be merely a more than usually profuse period, are probably instances of such early miscarriages. Velpeau detected an ovum, of about fourteen days, which was not larger than an ordinary pea; and it is easy to understand how so small a body should pass unnoticed in the blood which escapes along with it.

Up to the end of the third month, when miscarriage occurs, the entire ovum is generally cast off *en masse*, the decidua subsequently coming away in shreds, or as an entire membrane. The abortion is then comparatively easy. From the third to the sixth month, after the placenta is formed, the amnion is, as a rule, first ruptured by the uterine contractions, and the fœtus is expelled by itself. The placenta and its membranes may then be shed as in ordinary labor. It often happens, however, that, on account of the firmness of the placental adhesion at this period, the secundines are retained for a greater or less length of time. This subjects the patient to many risks, especially to those of profuse hemorrhage, and of septicæmia. There can be no doubt that, for this reason, premature termination of the pregnancy is attended by much greater danger to the mother between the third and sixth months than at an earlier or later date. After the sixth month the course of events is not different from those attending ordinary labor. The prognosis to the child is more unfavorable in proportion to the distance from the full period of gestation at which premature labor takes place.

The *causes* of abortion may conveniently be subdivided into the *predisposing* and *exciting*, the latter being often slight, and such as would have no effect in inducing uterine contractions in women not rendered liable to the accident from the existence of one or other of the former class of causes. The predisposition to abortion may depend on some condition interfering with the vitality of the ovum or its relation to the maternal structures, or on certain conditions directly affecting the mother's health.

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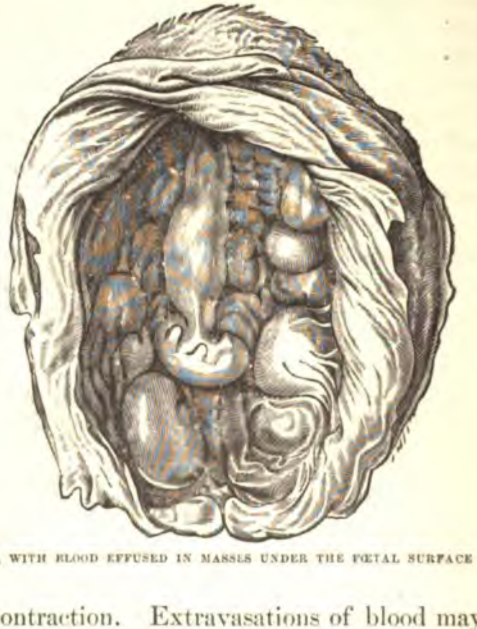
[1] Schroeder, Manual of Midwifery, p. 149.

Causes referable to the Fœtus.—One of the most common antecedents of abortion is the death of the fœtus, which leads to secondary changes, and ultimately produces the uterine contractions which end in its expulsion. The precise causes of death in any given case cannot always be accurately ascertained, as they sometimes depend on conditions which are traceable to the maternal structures, at others to the ovular only, or, it may be, to a combination of the two. Nor does it by any means follow that the death of the ovum immediately results in its expulsion. The mode in which death of the ovum produces abortion is not difficult to understand, for it necessarily leads to changes in the relations between the ovular and maternal structures; these changes cause hemorrhages—partly external, and partly into the membranes—which, in their turn, excite uterine contraction. Extravasations of blood may take place in various positions. One of the most common is into the decidual cavity, between the decidua vera and the decidua reflexa—or between the decidua vera and the uterine walls. If the hemorrhage is only slight, and especially if it comes from that portion of the decidua near the internal os, and at a distance from the ovum, there need be no material separation, and pregnancy may continue. This explains the cases we occasionally meet with, in which there is more or less hemorrhage during pregnancy, without subsequent abortion. When the amount of extravasated blood is at all great, separation and abortion necessarily result,

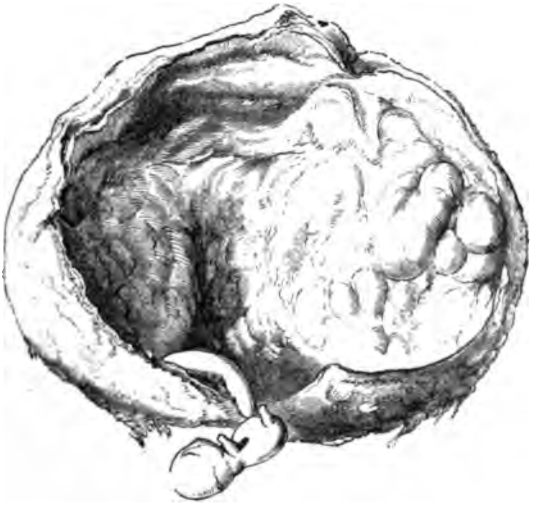
FIG. 85.



AN APOPLECTIC OVUM, WITH BLOOD EFFUSED IN MASSES UNDER THE FŒTAL SURFACE OF THE MEMBRANE.

and the decidua will be found on expulsion to have coagula on its surface, and between its various layers, which, on section, are found to project into the cavity of the amnion (Fig. 85). In other cases hemorrhage is still more extensive, and, after breaking through the decidua reflexa, it forms clots between it and the chorion, and even in the cavity of the amnion. Supposing expulsion to take place shortly after coagula are deposited among the membranes, the blood is little altered, and we have an ordinary abortion. If, however, the ovum is retained, the coagulated fibrine, and the placenta or membranes, undergo secondary changes, which lead to the formation of moles. The so-called *fleshy mole* (Fig. 86) is often retained for many weeks or months after the death of the fœtus, during which time there may be but little modification of the usual symptoms of pregnancy to attract attention ; or, as is frequently the case, it gives rise to occasional hemorrhage, until at last uterine contractions come on, and the contents of the uterus are cast off in the form of a thick fleshy mass, showing but little resemblance to the ordinary products of conception. The most probable explanation of its formation is, that when hemorrhage originally took place, the effusion of blood was not sufficient to effect the entire separation and expulsion of the ovum. Part of the membranes, or of the placenta, if that organ had commenced to form, retained its organic connection with the uterus, while the fœtus itself perished. The attached portion of the placenta and membranes continue to be nourished, although abnormally. The fœtus itself generally entirely disappears, especially if it has perished at an early period of utero-gestation, when it becomes dissolved in the liquor amnii. Or it may become macerated, shrivelled, and greatly altered in appearance. The effused blood becomes decolorized from the absorption of the corpuscles ; and, according to Scanzoni, fresh

FIG. 86.



BLIGHTED OVUM, WITH FLESHY DEGENERATION OF THE MEMBRANE.

vessels are developed in the fibrine, which increase the vascular attachment of the mole to the uterine walls. The placenta and membranes may go on increasing in thickness, until they form a mass of considerable size. Careful microscopic examination will almost always enable us to discover the villi of the chorion, altered in appearance, often loaded with granular fatty molecules, but sufficiently distinct to be readily recognizable.

Causes depending on the Maternal State.—Important as are the causes of abortion arising from some morbid condition of the ovum, they are not more so than those which depend on the maternal state; and it is to be observed that the former are often indirect causes, produced by primary maternal changes. Many of these maternal causes of abortion act by causing hyperæmia of the uterus, which leads to extravasation of blood. Thus, abortion is apt to occur in women who lead unhealthy lives, such as those who occupy overheated and ill-ventilated rooms, indulge to excess in the fatigues and pleasures of society, in the use of alcoholic drinks and the like. Over-frequent coitus has been, for the same reason, observed to produce a remarkable tendency to abortion, and Parent-Duchatelet has noted that it is of very frequent occurrence amongst women of loose life. Many diseases strongly predispose to it, such as fevers, zymotic diseases of all kinds, measles, scarlet fever, small-pox; and diseases of the respiratory organs, such as bronchitis and pneumonia. Syphilis is well known to be one of the most frequent causes, and one that is likely to act in successive pregnancies. It may act so that the pregnancy is brought to a premature termination, time after time, until the constitutional disease is eradicated by appropriate treatment. It undoubtedly acts in some cases through the influence of the father in producing a diseased ovum; and it is the only cause which can with certainty be traced to the state of the father's health. Many other morbid conditions of the blood also dispose to abortion. It has been observed to be a frequent result of lead-poisoning; also of the presence of noxious gases in the atmosphere, such as an excess of carbonic acid.

Nervous System.—Many causes act through the nervous system, such as fright, anxiety, sudden shock, and the like. Thus, there are numerous instances on record in which women aborted suddenly after the receipt of some bad news, and it is said to have been of frequent occurrence in women immediately before execution. The influence of irritations propagated through the nervous system from a distance, tending to produce uterine contraction and abortion through the agency of reflex action, has been specially dwelt upon by Tyler Smith. Thus, he points out that abortion is not unfrequently met with, from the irritation of constant suckling, in women who become pregnant during lactation. The effect of suckling in producing uterine contraction is, indeed, well known, and the application of the child to the breast, for this purpose, has long been suggested as a method of treatment in post-partum hemorrhage. The irritation of the trifacial, in severe toothache; of the renal nerves in cases of gravel, or calculus, &c.; of the intestinal nerves in excessive vomiting, or diarrhœa, obstinate constipation, ascarides, etc., all act in the same way. We may, perhaps, also explain by this hypothesis the fact, which can hardly be doubted, that women are more apt to abort at what would have been the menstrual epoch than at other times, as the ovarian nerves may then be subject to undue excitement. It is probable, however, that there may be also at these times more or less active congestion about the decidua, which may predispose to laceration of its capillaries and blood extravasation. There can be little doubt that such congestion exists in those exceptional cases in which menstruation continues for one or more periods after conception, the blood probably escaping from the space between the decidua vera and reflexa; and therefore there is no reason to question its also happening even when such abnormal menstruation is not present.

Certain *physical causes* may produce abortion by separating the ovum. Thus, it may follow a fall, a blow, slipping down stairs, or other accidents of a trivial character. On the other hand, women may be subjected to injuries of the severest kind without aborting. The probability, therefore, is that these apparently trivial causes only operate in women who, for some other reason, are predisposed to the accident. This is borne out by the fact—which is well known in these days, when the artificial production of abortion is, unhappily, far from a very rare event—that it is by no means easy to destroy the vitality of the fœtus. I myself know of a case in which the uterine sound was passed several times into a pregnant uterus without producing abortion, the pregnancy eventually proceeding to term. Oldham has related a similar case in which he in vain attempted to bring it on by the sound in a case of contracted pelvis; and Duncan has mentioned an instance in which an intra-uterine stem pessary was unwittingly introduced, and worn for some time, by a pregnant woman, without any bad effect. The fact that pregnancy is with difficulty interfered with when there is a healthy relation between the ovum and the uterus, no doubt explains the disastrous effects of criminal abortion, which have been especially insisted on by many of our American brethren.

Morbid states of the uterus itself have an important influence in the production of abortion. Any condition which mechanically interferes with the proper development of the uterus is apt to operate in this way. Amongst these may be mentioned fibroid tumors; the presence of old peritoneal adhesions, rendering the womb a more or less fixed organ; but, above all, flexion and displacement of the uterus. Retroflexion of the uterus is, unquestionably, one of the most frequent factors in its production, not only on account of the irritation which the abnormal position sets up, but from the interference with the uterine circulation, which leads to the effusion of blood and the death of the ovum. An inflamed condition of the cervical and uterine mucous membranes will act in the same way, should pregnancy have occurred; although such a condition more often prevents conception taking place.

Symptoms.—One of the earliest indications of impending abortion is more or less hemorrhage. This may at first be slight, and may last for a short time only, again recurring after an interval of time; or it may commence with a sudden and profuse discharge. Occasionally it is very abundant, and its continuance and amount form one of the gravest symptoms of the accident. After the loss of blood has continued for a greater or less length of time, it may be even for some days, uterine contractions come on, recurring at regular intervals, and eventually leading to the expulsion of the ovum. More rarely the impending miscarriage commences with pains, which lead to laceration of vessels and hemorrhage.

As long as one or other of these symptoms exists alone, we may hope to avert the threatened miscarriage; but it may, I think, be taken for granted that when both occur together there is little or no chance of its being arrested. Certain premonitory symptoms are described by authors as common in abortion, such as feverishness, shivering, a sensation of coldness; all of which are obscure and unreliable, and are certainly much more frequently absent than present.

If the pregnancy be early, it is probable that the entire ovum will be shed with little trouble, and it often passes unperceived in the clots which surround it. It is therefore of importance that all the discharges should be very carefully examined. After the second month the rigid and undilated cervix presents a formidable obstacle to the escape of the ovum, and it may be a considerable time before there is sufficient dilatation to admit of its passage. This is gradually effected by the continuance of pains, but not without a severe loss of blood. It may be that the amnion is ruptured, and the fœtus expelled first. After a lapse of time the secundines are also shed; but there may be a considerable delay, amounting even to days, before this is effected. As long as any portions of the membranes are retained in utero, the patient is necessarily subjected to considerable risk, not only from the continuance of hemorrhage, but also from septicæmia. Hence it may be laid down as a rule that we can never consider our patient out of danger until we have satisfied ourselves that the whole of the uterine contents have been expelled.

Treatment.—Our first endeavor in any case of impending miscarriage will be, of course, to avert the threatened accident. If hemorrhage has not been excessive, and if, on vaginal examination, which should always be practised, we find no dilatation of the os, we may entertain a reasonable hope of success. If, on the contrary, we find the os beginning to open, if we are able to insert the finger through it so as to touch the ovum, especially if pains also exist, we are justified in considering abortion to be inevitable, and the indication will then be to have the ovum expelled, and the case terminated as soon as possible. In the former case the most absolute rest is the first thing to insist on. The patient should be placed in bed, not overburdened with clothes, in a cool temperature, and she should have a light and easily assimilated diet. All movements, even rising out of bed to empty the bladder or bowels, should be absolutely prohibited. To avert the tendency to the commencement of uterine contraction there is no remedy so useful as opium, which must be given freely, and frequently repeated. It may be administered either in the form of laudanum, or of Battley's sedative solution, which has the advantage of producing less general disturbance. It may be advantageously exhibited in doses of from 20 to 30 minims, and repeated after a few hours. A still better preparation is chlorodyne, which I have found of extreme value in arresting impending miscarriage, in doses of 15 minims, repeated every third or fourth hour. If, from any cause, it is considered unadvisable to give the sedative by the mouth, it may be administered in a small starch enema *per rectum*. In all cases it will be necessary to keep the patient more or less under the influence of the drug for several days, and until all symptoms of miscarriage have passed away. Care should be taken that the bowels do not become locked up by the action of the opiates—as this might of itself be a cause of irritation—and their constipating effects ought to be obviated by small doses of castor oil, or other gentle aperient. Various subsidiary methods of treatment have been recommended, such as bleeding from the arm, or the local application of leeches, in supposed plethoric states of the system; revulsives, such as dry cupping to the loins; the application of ice, to check hemorrhage; astringents, such as acetate of lead or gallic acid, for the same purpose. Most of these, if not positively hurtful, will be, at least, useless. The cases in which venesection would be beneficial are extremely rare, and the local applications, especially cold, are much more apt to favor than to prevent uterine action.

Prophylactic Treatment.—In cases of repeated miscarriage in successive pregnancies, a special course of prophylactic treatment is indicated, and is often attended with much success. In cases of this kind the first indication, and one which ought to be very carefully attended to, is to seek for and, if possible, to remove or mitigate the cause which has given rise to the former abortions. Those causes which depend on constitutional states must first be carefully investigated, and treated according to the indications present. These may be obscure and not easily discovered; but it is certainly unwise to assume too readily the existence of what has been called "a habit of abortion," which further enquiry may prove to be only an indication of constitutional debility, degeneracy of the placental structures, or a latent and unsuspected syphilitic taint. If constitutional debility be present to a marked extent, a generous diet and a restorative course of treatment (preparations of iron, quinine, and other suitable tonics) may effect the desired object.

Local congestion of the uterus, or a general plethoric state of the patient, have often been supposed to be efficient causes of recurring abortion. Dr. Henry Bennet has especially dwelt on the influence of congestion and abrasions of the cervix in causing premature expulsion of the fœtus,[1] and recommends the topical application of nitrate of silver, or other caustics, to the inflammatory abrasions existing on the neck of the womb. Formerly venesection was a favorite remedy; and many authors have recommended the local abstraction of blood by leeches applied to the groin, or round the anus, or even to the cervix. The influence of general plethora is more than doubtful; and although local congestions are, probably, much more effective causes, still it would seem more judicious to treat them by rest, and local sedatives, rather than by topical applications which, injudiciously applied, might produce the very accident they were intended to prevent.

The position of the uterus should, however, be carefully investigated. If it be found to be retroflexed, a well-fitting Hodge's pessary should be applied, so as to support it until it has completely risen out of the pelvis.

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[1] On Inflammation of the Uterus, p. 432.

The possibility of syphilitic infection should always be inquired into, for it is beyond any doubt that this poison may act on the product of conception long after all appreciable traces of it have disappeared from the infected parent. Should there be recurrent abortions in a patient who had formerly suffered from syphilis, or whose husband had at any time contracted the disease, no time should be lost in using appropriate anti-syphilitic remedies, which should invariably be administered both to the husband and wife. Diday especially insists that in such cases it is not sufficient to submit the father and mother to a mercurial course in the absence of pregnancy, but that as each successive impregnation occurs the mother should again commence anti-syphilitic treatment, even though she has no visible traces of the disease.[1] In this way there is reasonable ground for hoping that infection of the ovum may be prevented. I think, too, that we may be the more encouraged to persevere in the treatment of these unfortunate cases, from the fact that the syphilitic poison tends to wear itself out. I have seen several cases in which this taint at first produced early abortion, then each successive pregnancy was of longer duration, until eventually a living child was born.

In fatty degeneration of the chorion villi, and in other morbid states of the placenta, which act by preventing the proper nutrition of the fœtus and the due aeration of its blood, there is no reliable means of treatment except the general improvement of the mother's health. Simpson strongly recommended the administration of chlorate of potash in cases in which the child habitually dies in the latter months of pregnancy, on the supposition that it supplied to the blood a large amount of oxygen, and thus made up for any deficiency in the supply of that element through the placental tufts. The theory is, at best, a doubtful one, although I believe the drug to be unquestionably beneficial in cases of the kind. It probably acts by its tonic properties rather than in the manner Simpson supposed. It may be given in doses of 15 to 20 grains three times a day, and may be advantageously combined with small doses of dilute hydrochloric acid. In frequently recurring premature labors with dead children, Simpson strongly recommended the induction of premature labor a little before the time at which we had reason to believe that the fœtus had usually perished; or, in other words, before the placental disease had advanced sufficiently far to interfere with its nutrition. The practice has constantly been adopted with success, and is perfectly legitimate, but the difficulty, of course, is to fix on the right time. Careful auscultation of the fœtal heart may be of some use in guiding us to a decision, as the death of the fœtus is generally preceded for some days by irregular, tumultuous, and intermittent action of the heart.

There will always remain a certain number of cases in which no appreciable cause can be discovered. Under such circumstances prolonged rest, at least until the time has passed at which abortion formerly took place, will afford the best chance of avoiding a recurrence of the accident. There must always be some difficulty in carrying out this indication, inasmuch as the patient's health is apt to suffer in other ways from the confinement and the want of fresh air and exercise which it entails. The strictness with which rest should be insisted on must vary in different cases, but it should be specially attended to at what would have been the menstrual periods. At these times the patient should remain in bed altogether; at others she may lie on a sofa, and, if circumstances permit, spend part of the day, at least, in the open air. Sexual intercourse should be prohibited. Should actual symptoms of abortion come on, the preventive treatment, already indicated, may be resorted to. Great care, however, should be used in prescribing opiates as preventives, and they should be given for a specified time only. I have seen, more than once, an incurable habit of opium-eating originate from the incautious and too long continued exhibition of the drug in such cases.

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[1] Diday, Infantile Syphilis, [illegible] Trans., p. 207.

When we have satisfied ourselves that abortion is inevitable, we must proceed to employ treatment that favors the expulsion of the ovum.

If the os be sufficiently dilated, and the pains strong, we may find this separated and protruding from the os. We may then be able to detach it by the finger. For this purpose the uterus is depressed from without by the left hand, while an endeavor is made to scoop out the ovum with the examining finger. If it is out of reach, and yet appears detached, chloroform should be administered, the whole hand introduced into the vagina, and the finger into the uterine cavity. The complete detachment of the ovum can in this way be far more readily and safely effected than by using any of the many ovum-forceps which have been invented for the purpose.

Plugging of the Vagina.—If the ovum be not sufficiently separated, or the os be undilated, means must be taken to control the hemorrhage until the former can be removed or expelled. It is here that plugging of the vagina finds its most useful application. This may be done in various ways. That most usually employed is filling the vagina with a tolerably large sponge, in the interstices of which the blood coagulates. A better plan is to soak a number of pledgets of cotton wool in water and tie a string round each. The vagina can be completely and effectually packed with these; and this is best done through a speculum. Each pledget should be covered with glycerine, which prevents completely the offensive odor which otherwise always arises. The pledgets can be removed by traction on the strings, but if these are not used much pain is caused in getting them out of the vagina. The plug should never be left in for more than six or eight hours, after which a fresh one may be inserted if necessary. Two or three full doses of the liquid extract of ergot, of ʒss to ʒj each, may be given while the plug is in position. The plug itself is a strong excitant of uterine action, and the two combined often effect complete detachment, so that on the removal of the tampon the ovum may be found lying loose in the os uteri. If the os be undilated and the ovum entirely out of reach, the former may be opened by means of sponge or laminaria tents. Of these I think a well-prepared sponge tent the most effectual, and it can be maintained *in situ* by a vaginal plug below it. It also acts as a most efficient plug, effectually controlling all hemorrhage. In a few hours it opens up the os sufficiently to admit the finger.

Retention of the Membranes.—The most troublesome cases are those in which the fœtus is first expelled, and the placenta and membranes remain in utero. As long as this is the case the patient can never be considered safe from the occurrence of septicæmia. Dr. Priestley has strongly insisted on the importance of removing the secundines as soon as possible. There can be no doubt that this should be done whenever it is feasible. Cases, however, are frequently met with in which any forcible attempt at removal would be likely to prove very hurtful, and in which it is better practice to control hemorrhage by the plug or sponge tent, and wait until the placenta is detached, which it will generally be in a day or two at most. Under such circumstances fetor and decomposition of the secundines may be prevented by intra-uterine injections of Condy's fluid. Provided the os be sufficiently patulous to prevent the collection of the fluid in the uterine cavity, and not more than a drachm or two of fluid be injected at a time, so as simply to wash away and disinfect decomposing detritus, they can be used with perfect safety. Sometimes cases are met with in which the os has entirely closed, and in which we can only suspect the retention of the placenta by the history of the case, the continuance of hemorrhage, or the presence of a fetid discharge. Should we see reason to suspect this, the os must be dilated with sponge or laminaria tents, and the uterine cavity thoroughly explored under chloroform. This condition of things is far from uncommon in women who have not had medical assistance from the first, and it often gives rise to very troublesome and anxious symptoms. It has been said that placentæ thus retained have been completely absorbed; and cases of the kind have been related by Naegele and Osiander. The spontaneous absorption, however, of so highly organized a body as the placenta would be a phenomenon of the most remarkable character, and the evidence in proof of it is certainly far from sufficiently strong to force us to credit it; and it seems more natural to suppose that in cases of the kind the placenta has been cast off without the knowledge of the patient. Sometimes, however, the placenta never becomes entirely detached, and, retaining organic connection with the uterine walls, forms what has been called a "*placental polypus.*" This may produce secondary hemorrhages, in the same way as an ordinary fibroid polypus. Barnes recommends the removal of these masses by means of the wire écraseur. Before their detection the os uteri must be opened up.

The frequency with which abortion leads to chronic uterine disease should lead us to attach much more importance to the subsequent management of the patient than has been customary. The usual practice is to confine the patient to bed for two or three days only, and then to allow her to resume her ordinary avocations, on the supposition that a miscarriage requires less subsequent care than a confinement. The contrary of this is, however, most probably the case; for the uterus has been emptied when it is unprepared for involution, and that process is often very imperfectly performed. We should, therefore, insist on at least as much attention being paid to [illegible]er labor at term.

PART III.

LABOR.

CHAPTER I.

THE PHENOMENA OF LABOR.

IN considering delivery at term we have to discuss two distinct classes of events.

One of these is the series of vital actions brought into play in order to effect the expulsion of the child; and the other consists of the movements imparted to the child—the body to be expelled—in other words, the mechanism of delivery.

Causes of Labor.—Before proceeding to the consideration of these important topics, a few words may be said as to the determining causes of labor. This subject has been from the earliest times a *quæstio vexata* among physiologists; and many and various are the theories which have been broached to explain the curious fact that labor spontaneously commences, if not at a fixed epoch, at any rate approximately so. It must be admitted that, even yet, there is no explanation which can be implicitly accepted.

The explanations which have been given may be divided into two classes—those which attribute the advent of labor to the fœtus, and those which refer it to some change connected with the maternal generative organs.

The former is the opinion which was held by the older accoucheurs, who assigned to the fœtus some active influence in effecting its own expulsion. It need hardly be said that such fanciful views have no kind of physiological basis. Others have supposed that there might be some change in the placental circulation, or in the vascular system of the fœtus, which might solve the mystery. The latest hypothesis of this kind, which, however, is not fortified by any evidence, is by Barnes, who says, "I rather incline to the opinion that when the fœtus has attained its full development, when its organs are prepared for external life, some change takes place in its circulation, which involves a correlative disturbance in the maternal circulation, which excites the attempt at labor."[1]

The majority of obstetricians, however, refer the advent of labor to purely maternal causes. Among the more favorite theories is one, which was originally started in this country by Dr. Power, and adopted and illustrated by Depaul, Dubois, and other writers. It is based on the assumption that there is a sphincter action of the fibres of the cervix, analogous to that of the sphincters of the bladder and rectum, and that when the cervix is taken up into the general uterine cavity as pregnancy advances, the ovum presses upon it, irritates its nerves, and so sets up reflex action, which ends in the establishment of uterine contraction. This theory was founded on erroneous conceptions of the changes that occurred in the neck of the uterus; and, as it is certain that obliteration of the cervix does not really take place in the manner that Power believed when his theory was broached, it is obvious that its supposed result cannot follow.

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[1] Diseases of Women, p. 434.

Extreme distension of the uterus has been held to be the determining cause of labor; a view lately revived by Dr. King, of Washington,[1] who believes that contractions are induced because the uterus ceases to augment in capacity, while its contents still continue to increase. This hypothesis is sufficiently disproved by a number of clinical facts which show that the uterus may be subject to excessive and even rapid distension—as in cases of hydramnios, multiple pregnancy, and hydatiform degeneration of the ovum—without the supervention of uterine contractions.

Another inciter of uterine action has been supposed to be the separation of the ovum from its connections to the uterine parietes, in consequence of fatty degeneration of the decidua occurring at the end of pregnancy. The supposed result of this change, which undoubtedly occurs, is that the ovum becomes so detached from its organic adhesions as to be somewhat in the position of a foreign body, and thus incites the nerves so largely distributed over the interior of the uterus. This theory, which has been widely accepted, was originally started by Sir James Simpson, who pointed out that some of the most efficient means of inducing labor (such, for example, as the insertion of a gum-elastic catheter between the ovum and the uterine walls) probably acted in the same way, viz., by effecting separation of the membranes and detachment of the ovum.

Barnes instances, in opposition to this idea, the fact that ineffectual attempts at labor come on at the natural term of gestation in cases of extra-uterine pregnancy, when the fœtus is altogether independent of the uterus, and therefore, he argues, the cause cannot be situated in the uterus itself. A fair answer to this argument would be that although, in such cases, the womb does not contain the ovum, it does contain a decidua, the degeneration and separation of which might suffice to induce the abortive and partial attempts at labor then witnessed.

A serious objection to all these theories, which are based on the assumption that some local irritation brings on contraction, is the fact, which has not been generally appreciated, that uterine contractions are always present during pregnancy as a normal occurrence, and that they may be and often are readily intensified at any time, so as to result in premature delivery.

It is, indeed, most likely that, at or about the full term, the nervous supply of the uterus is so highly developed, and in so advanced a state of irritability, that it more readily responds to stimuli than at other times. If by separation of the decidua, or in some other way, stimulation of the excitor nerves is then effected, more frequent and forcible contractions than usual may result, and, as they become stronger and more regular, terminate in labor. But, allowing this, it still remains quite unexplained why this should occur with such regularity at a definite time.

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[1] American Journal of Obstetrics, vol. iii.

Tyler Smith tried, indeed, to prove that labor came on naturally at what would have been a menstrual epoch, the congestion attending the menstrual nisus acting as the exciter of uterine contraction. He therefore refers the onset of labor to ovarian, rather than to uterine, causes. Although this view is upheld with all its author's great talent, there are several objections to it difficult to overcome. Thus, it assumes that periodic changes in the ovary continue during pregnancy, of which there is no proof. Indeed, there is good reason to believe that ovulation is suspended during gestation, and with it, of course, the menstrual nisus. Besides, as has been well objected by Cazeaux, even if this theory were admitted, it would still leave the mystery unsolved, for it would not explain why the menstrual nisus should act in this way at the tenth menstrual epoch, rather than at the ninth or eleventh.

In spite, then, of the many theories at our disposal, it is to be feared that we must admit ourselves to be still in entire ignorance of the reason why labor should come on at a fixed epoch.

The *expulsion of the child* in labor is effected by the contractions of the muscular fibres of the uterus, aided by those of some of the abdominal muscles. These efforts are in the main entirely independent of volition. So far as regards the uterine contractions, this is absolutely true, for the mother has no power of originating, lessening, or increasing the action of the uterus. As regards the abdominal muscles, however, the mother is certainly able to bring them into action, and to increase their power by voluntary efforts; but, as labor advances, and as the head passes into the vagina and irritates the nerves supplying it, the abdominal muscles are often stimulated to contract, through the influence of reflex action, independent of volition on the part of the mother.

There can be little doubt that the chief agent in the expulsion of the child is the contraction of the uterus itself. This opinion is almost unanimously held by accoucheurs, and the influence of the abdominal muscles is believed to be purely accessory. Dr. Haughton, however, maintains a view which is directly contrary to this. From an examination of the force of the uterine contractions, arrived at by measuring the amount of muscular fibre contained in the walls of the uterus, he arrives at the conclusion that the uterine contractions are chiefly influential in rupturing the membranes and dilating the os uteri, bringing into action, if needful, a force equivalent to 54 lbs.; but when this is effected, and the second stage of labor has commenced, he thinks the remainder of the labor is mainly completed by the contractions of the abdominal muscles, to which he attributes enormous powers, equivalent, if needful, to a pressure of 523.65 lbs. on the area of the pelvic canal.

These views bear on a topic of primary consequence in the physiology of labor. They have been fully criticised by Duncan, who has devoted much experimental research to the study of the powers brought into action in the expulsion of the child. His conclusions are that, so far from the enormous force being employed that Haughton estimated, in the large majority of cases the effective force brought to bear on the child by the combined action of both the uterine and abdominal muscles is less than 50 lbs.—that is, less than the force which Haughton attributed to the uterus alone. In extremely severe labors, when the resistance is excessive, he thinks that an extra power may be employed, but estimates the maximum as not above 80 lbs., including in this total the action of both the uterine and abdominal muscles. Joulin arrived at the conclusion that the uterine contractions were capable of resisting a maximum force of about one hundredweight. Both these estimates, it will be observed, are much under that of Haughton, which Duncan describes as representing "a strain to which the maternal machinery could not be subjected without instantaneous and utter destruction."

There are many facts in the history of parturition which make it certain that the chief factor in the expulsion of the child is the uterus. Among these may be mentioned occasional cases in which the action of the abdominal muscles is materially lessened, if not annulled—as in profound anæsthesia, and in some cases of paraplegia—in which, nevertheless, uterine contractions suffice to effect delivery. The most familiar example of its influence, however, and one that is a matter of every-day observation in practice, is when inertia of the uterus exists. In such cases no effort on the part of the mother, no amount of voluntary action that she can bring to bear on the child, has any appreciable influence on the progress of the labor, which remains in abeyance until the defective uterine action is re-established, or until artificial aid is given.

The contraction of the uterus, then, being the main agent in delivery, it is important for us to appreciate its mode of action, and its effect on the ovum.

Uterine Contractions.—We have seen that intermittent and generally painless uterine contractions exist during pregnancy. As the period for delivery approaches, these become more frequent and intense, until labor actually commences, when they begin to be sufficiently developed to effect the opening up of the os uteri, with the view to the passage of the child. They are now accompanied by pain, which increases as labor advances, and is so characteristic that "pains" are universally used as a descriptive term for the contractions themselves. It does not necessarily follow that uterine contractions are painless until they commence to effect dilatation of the os uteri. On the contrary, during the last days or even weeks of pregnancy, women constantly have irregular contractions, accompanied by severe suffering, which, however, pass off without producing any marked effect on the cervix. When labor has actually begun, if the hand is placed on the uterus when a pain commences, the contraction of its muscular tissue is very apparent, and the whole organ is observed to become tense and hard, the rigidity increasing until the pain has reached its acme, the uterine walls then relaxing, and remaining soft until the next pain comes on. At the commencement of labor these pains are few, separated from each other by a considerable interval, and of short duration. In a perfectly typical labor the interval between the pains becomes shorter and shorter, while, at the same time, the duration of each pain is increased. At first they may occur only once in an hour or more, while eventually there may not be more than a few minutes' interval between them.

Dilatation of the Cervix.—If, when the pains are fairly established, a vaginal examination be made, the os uteri will be found to be thinned and dilated in proportion to the progress of the labor. During the contraction the bag of membranes will be felt to bulge, to become tense from the downward pressure of the liquor amnii within it, and to protrude through the os if it be sufficiently open. The membranes, with the contained liquor amnii, thus form a fluid wedge, which has a most important influence in dilating the os uteri. This does not, however, form the sole mechanism by which the os uteri is dilated, for it is also acted upon by the contractions of the muscular fibres of the uterus, which tend to pull it open. It is probable that the muscular dilatation of the os is effected chiefly by the longitudinal fibres, which, as they shorten, act upon the os uteri, the part where there is least resistance.

Partly then by muscular contraction, partly by mechanical pressure, the cervical canal is dilated, and as it opens up it becomes thinner and thinner, until it is entirely taken up into the uterine cavity.

Rupture of the Membranes.—There is no longer any obstacle to the passage of the presenting part of the child into the cavity of the pelvis, and the force of the pains now generally effects the rupture of the membranes, and the escape of the liquor amnii. There is, at this time, often observed a temporary relaxation in the frequency of the pains, which had been steadily increasing; but they soon recommence with increased vigor. If the abdomen be now examined, it will be observed to be much diminished in size, partly in consequence of the escape of the liquor amnii, partly from the descent of the fœtus into the pelvic cavity.

The character of the pains soon changes. They become stronger, longer in duration, separated by a shorter interval, and accompanied by a distinct forcing effort, being generally described as "the bearing down" pains. Now is the time at which the accessory muscles of parturition come into operation. The patient brings them into play in the manner which will be subsequently described, and the combined action of the uterine and abdominal muscles continues until the expulsion of the child is effected.

The precise mode of uterine contraction is still somewhat a matter of dispute. It is generally described as commencing in the cervix, passing gradually upwards by peristaltic action, the wave then returning downwards towards the os uteri. This view was maintained by Wigand, and has been endorsed by Rigby, Tyler Smith, and many other writers. In support of it they instance the fact that, on the accession of a pain, the presenting part first recedes, the bag of membranes then becomes tense and protrudes through the os, and it is not until some time that the presenting part of the child itself is pushed down. It is very doubtful if this view is correct; and a careful examination of the course of the pains would rather lead to the belief that the contractions commence at the fundus, where the muscular tissue is most largely developed, and gradually proceed downward to the cervix; the waves of contraction being, however, so rapid that the whole organ seems to harden *en masse.* The apparent recession of the presenting part, and the bulging of the bag of membranes, are certainly no proof that the contractions begin at the cervix; for the commencing contraction would necessarily push down the fluid in front of the head, and cause the membranes to bulge, and the os to become tense, before its force was brought to bear on the fœtus itself. Indeed, did the contraction commence at the lower part of the uterus we should expect the opposite of what takes place to occur, and the waters to be pushed upwards, and away from the cervix. The fundal origin of the contraction is further illustrated by what is observed when the hand of the accoucheur is placed in the uterine cavity, as often happens in certain cases of hemorrhage or turning; for if a pain then comes on, it will be felt to start at the fundus and gradually compress the hand from above downwards.

The intermittent character of the contractions is of great practical importance. Were they continuous, not only would the muscular powers of the patient be rapidly exhausted, but, by the obliteration of the vessels produced by the muscular contraction, the circulation through the placenta would be interfered with, and the life of the child imperilled. Hence one of the chief dangers of protracted labor, especially after the escape of the liquor amnii, is that the uterine fibres may enter into a state of tonic rigidity, a condition that cannot be long continued without serious risks both to the mother and child.

The fact that the uterine contractions are altogether involuntary proves them to be excited—as indeed we would *a priori* infer from our knowledge of the anatomical arrangement of the nerves of the uterus—solely by the sympathetic system. Still, it is a fact of every-day observation that they can be largely influenced by emotions. Various stimuli applied to the spinal system of nerves (as for example when the mammæ are irritated) have also a marked effect in inducing uterine contraction. The precise mode in which such influence is conveyed to the uterus, in spite of the numerous experiments which have been made for the purpose of determining how far labor is affected by destruction of the spinal cord, is still a matter of doubt. After the fœtus has passed through the cervix, the spinal nerves distributed to the vagina and perinæum are excited by the pressure of the presenting part, and through them the accessory powers of parturition are chiefly brought into play. The contraction of the muscles of the vagina itself is supposed to have some influence in favoring the expulsion of the fœtus after the birth of part of the body, and also in promoting the expulsion of the placenta. In the lower animals the vagina has a very marked contractile property, and is, in some of them, the main agent by which the young are expelled. In the human subject this influence is certainly of very secondary importance.

The amount of suffering experienced during labor varies much in different cases, and is, no doubt, in direct proportion to the nervous susceptibility of the patient. There are some women who go through labor with little or no pain at all. This is proved by the cases (of which there are numerous authentic instances recorded) in which labor has commenced during sleep, and the child has been actually born without the mother awaking. I am acquainted with a lady, who has had a large family, who assures me that, though the labor is accompanied by a sense of pressure and discomfort, she experiences nothing which can be called actual pain. Such a happy state of affairs is, however, extremely exceptional, and, in the vast majority of cases, parturition is accompanied by intense suffering during its whole course, in some cases amounting to anguish which has probably no parallel under any other condition.

The precise cause of the pain has been much discussed, and is, no doubt, complex.

In the early stage of labor, and before the dilatation of the os, it is chiefly seated in the back, from whence it shoots round the loins and down the thighs. It is then probably produced partly by the pressure on the nerve filaments caused by the contraction of the muscular fibres to which they are distributed, and partly by the stretching and dilatation of the muscular tissue of the cervix. M. Beau believes that in this stage the pain is not produced, strictly speaking, in the uterus itself, but is rather a neuralgia of the lumbo-abdominal nerves. The pains at this time are generally described as "acute" and "grinding," terms which sufficiently well express their nature. In highly nervous women these pains are often much less well borne than those of a later stage, and the suffering they undergo is indicated by their extreme restlessness and loud cries as each contraction supervenes. As the os dilates, and the labor advances into the expulsive stage, other sources of suffering are added.

The presenting part now passes into the vagina and presses on the vaginal nerves, as well as on the large nervous plexuses lying in the pelvis. As it descends lower it stretches the perinæum and vulva, and presses on the bladder and rectum. Hence cramps are produced in the muscles supplied by the nerve plexuses, as well as an intolerable sense of tearing and stretching in the vulva and perinæum, and often a distressing feeling of tenesmus in the bowels. By this time the accessory muscles of parturition are brought into action, and they, as well as the uterine muscles, are thrown into frequent and violent contractions, which, independently of the other causes mentioned, are sufficient of themselves to produce great pain, likened to that of colic, produced by involuntary and repeated contraction of the muscles of the intestines.

Taking all these causes into consideration, there is no lack of sufficient explanation of the intolerable suffering which is so constant an accompaniment of child-birth.

The *effect of the pains* on the mother's circulation is well marked. The rapidity of the pulse increases distinctly with each contraction, and, as the pain passes off, it again declines to its former state. A similar observation has been made with regard to the sounds of the fœtal heart, especially after the expulsion of the liquor amnii. Hicks has pointed out that during a pain the muscular vibrations give rise to a sound which often resembles that of the fœtal heart, and which completely disappears when the muscular tissue relaxes. The effect of the pain in intensifying the uterine souffle has been already mentioned. The strong muscular efforts would naturally lead us to expect a marked elevation of temperature during labor. Further observations on this point are required; but Squire asserts that there is generally only a very slight increase in temperature during delivery, rapidly passing off as soon as labor is over.

Such being the physiological facts in connection with the labor pains, we may now describe the ordinary progress of a natural labor—that is, one terminated by the natural powers and with the head presenting.

For facility of description, obstetricians have long been in the habit of dividing the course of labor into *stages*, which correspond pretty accurately with the natural sequence of events. For this purpose we generally talk of three stages: viz., 1, from the commencement of regular pains until the complete dilatation of the cervix; 2, from the complete dilatation of the cervix until the expulsion of the child; 3, the concluding stage, comprising the permanent contraction of the uterus and the separation and expulsion of the placenta. To these we may conveniently add a preparatory stage, antecedent to the regular commencement of the labor.

Preparatory Stage.—For a short time before delivery, varying from a few days to a week or two, certain premonitory symptoms generally exist, which indicate the approaching advent of labor. Sometimes they are well marked, and cannot be mistaken; at others they are so slight as to escape observation. Amongst the most common is a *sinking of the uterus* into the pelvic cavity, resulting from the relaxation of the soft parts preceding delivery. The result is, that the upper edge of the uterine tumor is less high than before, and, in consequence, the pressure on the respiratory organs is diminished, and the woman often feels lighter, and altogether less unwieldy, than in the previous weeks. If a vaginal examination be made at this time, the lower segment of the uterus will be found to have sunk lower into the pelvic cavity; and the consequence of this is that, while the respiration is less embarrassed, and the patient feels less bulky, other accompaniments of pregnancy, such as hemorrhoids, irritability of the bladder and bowels, œdema of the limbs, become aggravated. The increased pressure on the bowels often induces a sort of temporary diarrhœa, which is so far advantageous that it empties the bowels of fæces which may have collected within them. As has already been pointed out, the contractions which have been going on at intervals during the latter months of pregnancy now get more and more marked, and they have the effect of producing a real shortening of the cervix, which is of great value preparatory to its dilatation. More marked mucous discharge from the cavity of the cervix also generally occurs a short time before labor, and it is not unfrequently tinged with blood from the laceration of minute capillary vessels. This discharge, popularly known as the "*shows*," is a pretty sure sign that labor is not far off. It may, however, be entirely absent, even until the birth of the child. When copious, it serves to lubricate the passages, and is generally coincident with rapid dilatation of the parts, and a speedy labor.

False Pains.—During this time (premonitory stage) painful uterine contractions are often present, which, however, have no effect in dilating the cervix. In some cases they are frequent and severe, and are very apt to be mistaken for the commencement of real labor. Such "false pains," as they are termed, are often excited and kept up by local irritations, such as a loaded or disordered state of the intestinal canal; and they frequently give rise to considerable distress, and much inconvenience both to the patient and practitioner. They are, it should be remembered, only the normal contractions of the uterus, intensified and accompanied with pain.

First Stage, or Dilatation.—As labor actually commences, the uterine contractions become stronger, and the fact that they are "true" pains can be ascertained by their effect on the cervix. If a vaginal examination be made during one of these, the membranes will be felt to become tense and bulging during the pain, and the os uteri will be found partially dilated, and thinned at its edges. As labor advances, this effect on the os becomes more and more marked. At first the dilatation is very slight, perhaps not more than enough to admit the tip of the examining finger, and both the upper and lower orifices of the cervix can be made out. As the pains get stronger and more frequent, dilatation proceeds in the way already described, and the cervix gets more thin and tense, until we can feel a thin circular ring (which is lax between the pains, but becomes rigid and tense during the contraction, when the bag of water bulges through it), without any distinction between the upper and lower orifices. During this time the patient, although she may be suffering acutely, is generally able to sit up and walk about. The amount of pain experienced varies much according to the character of the patient. In emotional women of highly-developed nervous susceptibilities it is generally very great. They are restless, irritable, and desponding, and when the pain comes on cry out loudly. The character of the cry is peculiar and well marked during the first stage, and has constantly been described by obstetric writers as characteristic. It is acute and high, and is certainly very different from the deep groans of the second stage, when the breath is involuntarily retained to assist the parturient effort. When dilatation is nearly completed, various reflex nervous phenomena often show themselves. One of these is nausea and vomiting; another is uncontrollable shivering, which is not accompanied by a sense of coldness, the patient being often hot and perspiring. Both these symptoms indicate that the propulsive stage will shortly commence; and they may be regarded as favorable rather than otherwise, although they are apt to alarm the patient and her friends. By this time the os is fully dilated, the membranes generally rupture spontaneously, and a considerable portion of the liquor amnii flows away. The head, if presenting, however, often acts as a sort of ball-valve, and, falling down on the aperture of the cervix, prevents the complete evacuation of the liquor amnii, which escapes by degrees during the rest of the labor, or is often retained in considerable quantity until the birth of the child.

It not unfrequently happens, if the membranes are somewhat tougher than usual, and the pains frequent and strong, that the fœtus is pushed through the pelvis, and even expelled; surrounded with the membranes. When this occurs, the child is said to be born with a "caul," and this event would doubtless happen more frequently than it does, were it not the custom of the accoucheur to rupture the membranes artificially as soon as the os is completely opened up, after which time their integrity is no longer of any value.

Second Stage.—The os is now entirely retracted over the presenting part, and is no longer to be felt, the vagina and the uterine cavity forming a single canal. Now the mucous discharge is generally abundant, so that the examining finger brings away long strings of glairy transparent mucus, tinged with blood. The pains, after a short interval of rest, become entirely altered in character. The uterus contracts tightly round the fœtus, the presenting part descends into the pelvis, and the true propulsive pains commence. The accessory muscles of parturition now come into play. With each pain the patient takes a deep inspiration, and thus fills the chest, so as to give a *point d'appui* to the abdominal muscles. For the same reason she involuntarily seizes hold of some point of support, as the hand of a bystander, or a towel tied to the end of the bed, and at the same time pushes with her feet against the end of the bed, and so is able to bear down to advantage. The cries are no longer sharp and loud, but consist of a series of deep suppressed groans, which correspond to a succession of short expirations made during the straining effort. In this way the abdominal muscles contract forcibly on the uterus, which they further stimulate to action by pressing upon it. It is to be observed that these straining efforts are, to a considerable extent, under the control of the patient. By encouraging her to hold her breath and bear down, they can be intensified, while if we wish to lessen them we can advise her to call out; and when she does so the abdominal muscles have no longer a fixed point of action. Although the patient may thus lessen the effect of these accessory muscles, it is entirely out of her power to stop their action altogether. As labor advances, the head descends lower and lower, receding somewhat in the intervals between the pains, until eventually it comes down on the perinæum, which it soon distends.

Birth of the Child.—The pains now get stronger and more frequent, often with scarcely a perceptible interval between them, until the perinæum gets stretched by the advancing head. In the interval between the pains the elasticity of the perinæal structures pushes the head upwards, so as to diminish the tension to which the perinæum is subjected, the next pain again putting it on the stretch, and protruding the head a little further than before. By this alternate advance and recession, the gradual yielding of the structures is favored, and risk of laceration greatly diminished. During this time the pressure of the head mechanically empties the bowel of its contents. During the last pains, when the perinæum is stretched to the utmost, the anal aperture is dilated, sometimes to the size of a five-shilling piece; and in this way the perinæum is relaxed, just as the distension, and consequent risk of laceration, are at their maximum. The apex of the head now protrudes more and more through the vulva, surrounded by the orifice of the vagina, and eventually it glides over the perinæum and is expelled.

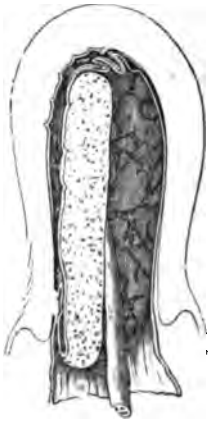
The intensity of the suffering at this moment generally causes the patient to call out loudly. The force of the abdominal muscles is thus lessened at the last moment, and this, in combination with the relaxation of the sphincter ani, forms an admirable contrivance for lessening the risk of perinæal injury. The rest of the body is generally expelled immediately by a single pain, and with it are discharged the remains of the liquor amnii, and some blood-clots from separation of the placenta; and so the second stage of labor terminates.

The *third stage* commences after the expulsion of the child. It is of paramount importance to the safety of the mother that it should be conducted in a natural and efficient manner; for it is now that the uterine sinuses are closed, and the frail barrier by which nature effects this may be very readily interfered with, and serious and even fatal loss of blood ensue. Unfortunately, it is too often the case that the practitioner's entire attention is fixed on the expulsion of the child, so that the natural history of the rest of delivery is very generally imperfectly studied and understood.

As soon as the child is expelled, the uterine fibres contract in all directions, and the hand, following the uterus down, will find that it forms a firm rounded mass lying in the lower part of the abdominal cavity. By retraction of its internal surface, the placental attachments are generally separated, and the after-birth remains in the cavity of the uterus as a foreign body.

The escape of blood from the open mouths of the uterine sinuses is now prevented in two ways, viz., (1) by the contraction of the uterine walls, and the more firm, persistent, and tonic this is, the more certain is the immunity from hemorrhage; (2) by the formation of coagula in the mouths of the vessels. Any undue haste in promoting the expulsion of the placenta tends to prevent the latter of these two hæmostatic safeguards, and is apt to be followed by loss of blood. After a certain time, averaging probably from a quarter to half an hour, the uterus will be felt to harden, and, if the case be solely left to nature, what has been aptly called a miniature labor occurs. Pains come on, and the placenta is spontaneously expelled from the uterus, either into the canal of the vagina, or even externally. In most obstetric works it is stated that the after-birth may be separated either from its centre or edge, and that it is very generally expelled through the os in an inverted form, with its fœtal surface downwards, and folded transversely on itself. That this is the mode in which the placenta is often expelled, when traction on the cord is practised, is a matter of certainty. It then passes through the os very much in the shape of an inverted umbrella. It is certain, however, that this is not the natural mechanism of its delivery. What this is has been well illustrated by Duncan,[1] who has very

FIG. 87.



MODE IN WHICH THE PLACENTA IS NATURALLY EXPELLED.

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[1] Edin. Med. Journ., April, 1871.

clearly shown that, when this stage of labor is left entirely to nature, the separated placenta is expelled edgeways, its uterine and detached surface gliding along the inner surface of the uterus, the foldings of its structure being parallel to the long diameter of the uterine cavity (Fig. 87). In this way it is expelled into the vagina, and during the process little or no hemorrhage occurs. When the placenta is drawn out in the way too generally practised, it obstructs the aperture of the os, and, acting like the piston of a pump, tends to promote hemorrhage. The corollaries as to treatment drawn from these facts will be subsequently considered. I am anxious, however, here to direct attention to nature's mechanism, because I believe there is no part of labor about the management of which erroneous views are more prevalent than that of this stage, and none in which they are more apt to lead to serious consequences; and unless the mode in which nature effects the expulsion of the placenta and prevents hemorrhage is thoroughly understood, we shall certainly fail in assisting her in a proper manner. In the large proportion of cases, when left entirely to themselves, the placenta would be retained, if not in the uterus, at any rate in the vagina, for a considerable time—possibly for several hours—and such delay would very unnecessarily tire the patience of the practitioner and be prejudicial to the patient. It is, therefore, our duty, in the majority of cases, to promote the expulsion of the after-birth; and when this is properly and scientifically done, we increase, rather than diminish, the patient's safety and comfort. But, in order to do this, we must assist nature, and not act in opposition to her method, as is so often the case.

When once the placenta is expelled, the uterus contracts still more firmly, and, in a typical case, is felt just within the pelvic brim, hard and firm, and about the size of a cricket-ball. Generally for several hours, or even for one or two days, it occasionally relaxes and contracts, and these contractions give rise to the "after-pains" from which women often suffer much. The object of these pains is no doubt to expel any coagula that may remain in the uterus, and therefore, however unpleasant they may be to the patient, they must be considered, unless very excessive, to be salutary rather than otherwise.

Duration of Labor.—The length of labor varies extremely in different cases, and it is quite impossible to lay down any definite rules with regard to it. Subject to exceptions, labor is no longer in primiparæ than in multiparæ, on account of the greater resistance of the soft parts in the former, especially of the structures about the vagina and vulva. It is also generally stated that the difficulty of labor increases with the age of the patient, and that in elderly primiparæ it is likely to be unusually tedious from rigidity of the soft parts. It is very doubtful if this opinion has any real basis, and in such cases the practitioner often finds himself agreeably disappointed in the result. Mr. Roper,[1] indeed, argues that the wasting of the tissues which occurs after forty years of age diminishes their resistance, and that first labors, after that age, are easier, as a rule, than in early life. The habits and mode of life of patients have no doubt a considerable influence on the duration of labor, but we are not in possession of any very reliable facts with regard to this subject. It is reasonable to suppose that the tissues of large, muscular, strongly-developed women will offer more resistance than those of slighter build. On the other hand, women of the latter class, especially in the upper ranks of life, more often develop nervous susceptibilities, which may be expected to influence the length of their labors. The average duration of labor, calculated from a large number of cases, is from eight to ten hours; even in primiparæ, however, it is constantly terminated in one or two hours from its commencement, and may be extended to twenty-four hours without any symptoms of urgency arising. In multiparæ it is frequently over in even a shorter time. Indications calling for interference may arise at any time during the progress of labor, independently of its length. The proportion between the length of the first and second stages also varies considerably. The first stage is generally the longest, and is stated by Cazeaux to be normally about twice the length of the second. This is probably under the mark, and I believe Joulin to be nearer the truth in stating that the first stage should be to the second as four or five to one, rather than as two to one. Often when the first stage has been very prolonged, the second is terminated rapidly.

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[1] Obst. Trans., v. 7.

The practitioner is constantly asked as to the probable length of labor; and the uncertainty of this should always lead him to give a most guarded opinion. Even when labor is progressing apparently in the most satisfactory manner, the pains frequently die away, and delivery may be delayed for many hours. In the first stage a cervix that is apparently rigid and unyielding may rapidly and unexpectedly dilate, and delivery soon follow. In either case, if the practitioner has committed himself to a positive opinion he is apt to incur blame; and it is far better always to be extremely cautious in our predictions on this point.

A somewhat larger proportion of deliveries occur in the early hours of the morning than at other times. Thus, West[1] found that, out of 2019 deliveries, 780 took place from 11 P.M. to 7 A.M., 662 from 7 A.M. to 3 P.M., and 577 from 3 P.M. to 11 P.M.

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[1] Amer. Med. Journ., 1854.

CHAPTER II.

MECHANISM OF DELIVERY IN HEAD PRESENTATIONS.

IT is quite impossible to over-estimate the importance of thoroughly understanding the mechanical phenomena which accompany the passage of the fœtus through the pelvis. These, which have very properly been termed the alphabet of obstetrics, dominate the whole scientific practice of midwifery, and it is absolutely impossible for the practitioner to acquire more than a merely empirical knowledge, such as may be possessed by any uneducated midwife, or to conduct the more difficult cases requiring operative interference, with safety to the patient or satisfaction to himself, unless he thoroughly masters the subject.

In treating of the physiological phenomena of labor, it was assumed that we had to do with an ordinary case of head presentation, the description being applicable, with slight variations, to presentations of other parts of the fœtus. So in discussing the mechanical phenomena of delivery, I shall describe more in detail the mechanism of head presentation, reserving any account of the mechanism of other presentations until they are separately studied. Head presentation is so much more frequent than that of any other part—amounting to 95 per cent. of all cases—that this mode of studying the subject is fully justified; and when once the student has mastered the phenomena of delivery in head presentations, he will have little difficulty in understanding the mechanism of labor when other parts of the fœtus present, based, as it always is, on the same general plan.

In entering on this study we come to appreciate the importance of the sutures and fontanelles in enabling us to detect the position of the fœtal head, and to watch its progress through its canal; and unless the "tactus eruditus," by which these can be distinguished from each other, has been acquired, the practitioner will be unable to satisfy himself of the exact progress of the labor. Nor is this always easy. Indeed, it requires considerable experience and practice before it is possible to make out the position of the head with absolute certainty; but this knowledge should always be aimed at, and the student will never regret the time and trouble he spends in acquiring it.

At the commencement of labor the long diameter of the head lies in almost any diameter of the pelvic brim, except in the antero-posterior, where there is not space for it. In the large majority of cases, however, it enters the pelvis in one or other of the oblique diameters, or in one between the oblique and transverse; but until it has fairly passed through the brim it certainly more frequently lies directly in the transverse diameter than has been generally supposed. Hence obstetricians have been in the habit of describing the h[illegible] in four positions, according to the parts of the pelvis to which the occiput of the child points; the first and third positions being those in which the long diameter of the fœtal head occupies the right oblique diameter of the pelvis, the second and fourth those in which it lies in the left oblique. Many subdivisions of these positions have been made, which only complicate the subject and render it more difficult to understand.

The positions, then, of the fœtal head after it has entered the brim, which it is of importance to be able to distinguish in practice, are:—

First (*or left occipito-cotyloid*). The occiput points to the left foramen ovale, the sinciput to the right sacro-iliac synchondrosis, and the long diameter of the head lies in the right oblique diameter of the pelvis.

Second (*or right occipito-cotyloid*). The occiput points to the right foramen ovale, the forehead to the left sacro-iliac synchondrosis, and the long diameter of the head lies in the left oblique diameter of the pelvis.

Third (*or right occipito-sacro-iliac*). The occiput points to the right sacro-iliac synchondrosis, the forehead to the left foramen ovale, and the long diameter of the head lies in the right oblique diameter of the pelvis. This position is the reverse of the first.

Fourth (*or left occipito-sacro-iliac*). The occiput points to the left sacro-iliac synchondrosis, the forehead to the right foramen ovale, and the long diameter of the head lies in the left oblique diameter of the pelvis. This position is the reverse of the second.

The relative frequency of these positions has long been, and still is, a subject of discussion among obstetricians. According to Naegele, to whose classical essay we owe the greater part of our knowledge of the subject, the head lies in the right oblique diameter in 99 per cent. of all cases. More recent researches have thrown some doubt on the accuracy of these figures, and many modern obstetricians believe that the second position, which Naegele believed only to be observed as a transitional stage in the natural progress of the third position, is much more common than he supposed. This question will be more fully discussed when we treat of the mechanism of occipito-posterior delivery, and, in the mean time, it may serve to show the discrepancy which exists in the opinions of modern writers, if we append the following table of the relative frequency of the various positions,[1] copied from Leishman's work:—

	First Position.	Second Position.	Third Position.	Fourth Position.	Not Classified.
Naegele	70.	—	29.	—	1.
Naegele, jun.	64.64	—	32.88	—	2.47
Simpson and Barry	76.45	.29	22.68	.58	—
Dubois	70.83	2.87	25.66	.62	—
Murphy	63.23	16.18	16.18	4.42	—
Swayne	86.36	9.79	1.04	2.8	—

Here it will be seen that all obstetricians are agreed as to the immensely greater frequency of the first position—the only point at issue being the relative frequency of the second and third.

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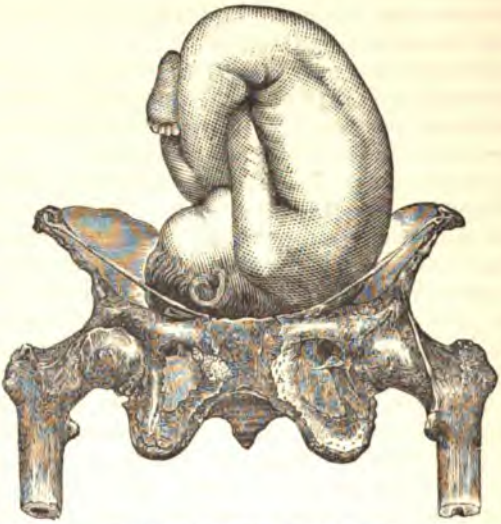
[1] Leishman's System of Midwifery, p. 341.

Various explanations have been given of the greater frequency with which the head lies in the right oblique diameter. By some it is referred to the natural tendency of the back of the fœtus, as shown by the experimental researches of Henig and other writers, to be directed, in consequence of gravitation, forwards and to the left side of the mother in the erect attitude, and backwards and to her right side in the recumbent. The explanation given by Simpson was that the head lay in the right oblique diameter in consequence of the measurement of the left oblique being more or less lessened by the presence of the rectum. When the rectum is collapsed, indeed, the narrowing of the diameter is slight; but it is so often distended by fæcal matter—sometimes, when constipation exists, to a very great extent—that it is not difficult to understand that it may really have a very important influence in determining the position of the fœtal head.

FIG. 88.



ATTITUDE OF CHILD IN FIRST POSITION.

In describing the mechanism of delivery, it will be well for us to concentrate our attention on the first, or most common position, dwelling subsequently more briefly on the differences between it and the less common ones.

Description of the First Position.—In this position, when the head commences to descend, the occiput lies in the brim pointing to the ileo-pectineal eminence of the left side, the forehead is directed to the right sacro-iliac synchondrosis, and the sagittal suture runs obliquely across the pelvis in the right oblique diameter. The back of the child is turned towards the left side of the mother's abdomen, the right shoulder to her right side, the left to her left side (Fig. 88). If a vaginal examination be now made (the patient lying in the ordinary obstetric position), and the os be sufficiently open, the finger will impinge upon the protuberance of the right parietal bone, which is described as the "presenting part," a term which has received various definitions, the best of which is probably that adopted by Tyler Smith, viz., "that portion of the fœtal head felt most prominently within the circle of the os uteri, the vagina, and the os tincæ, in the successive stages of labor." If the tip of the examining finger be passed slightly upwards, it will feel the sagittal suture running obliquely across the pelvis, and, if this be traced downwards and to the left, it will come upon the triangular posterior fontanelle, with the lambdoidal sutures diverging from it. If the finger could be passed sufficiently high in the opposite direction, upwards and to the right, it would come upon the large anterior fontanelle; but at this time that is too high up to be within reach. The chin is slightly flexed upon the sternum, this flexion, as we shall presently see, being greatly increased as the head begins to descend.

The head, at the commencement of labor, generally lies within the pelvic brim, especially in primiparæ. In multiparæ, in consequence of the relaxation of the abdominal parietes, the whole uterus is apt to fall somewhat forwards, and the head consequently is more entirely above the brim, but is pushed within it as soon as labor actually commences.

Naegele—and his description has been adopted by most subsequent writers—describes the head, at this period, as lying obliquely in relation to the brim, the right parietal bone, on which the examining finger impinges, being supposed by him to be much lower than the left. The accuracy of this view has of late years been contested, and it is now pretty generally admitted that this obliquity does not exist, and that the head enters the brim of the pelvis with both parietal bones on the same level, and with its bi-parietal diameter parallel to the plane of the inlet (Fig. 89). Naegele's view was adopted partly because the finger always felt the right parietal protuberance lowest, and partly because it was at that point that the "*caput succedaneum*," or swelling observed on the head after delivery, was always formed. Both arguments are, however, fallacious; for the right parietal bone is the part which would naturally be felt lowest, on account of the oblique position of the pelvis to the trunk; while, with regard to the caput succedaneum, it has been conclusively proved by Duncan that it does not form on the point most exposed to pressure, as Naegele assumed, but on the part of the head where there is least resistance to pressure—that is, the part lying over the axis of the vaginal canal.

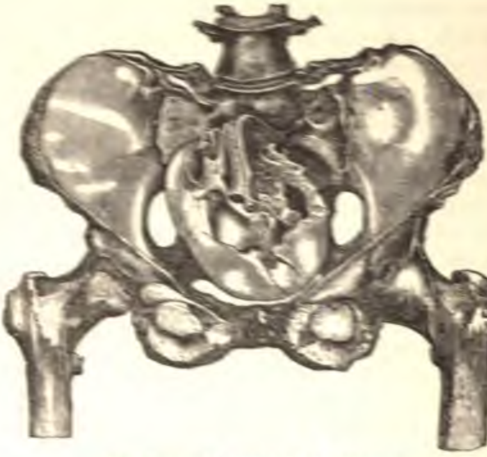
In tracing the mechanism of the progress of the head from the position just described, obstetricians have been in the habit of dividing the movements it undergoes into various stages, which are convenient for the purpose of facilitating description. It must be borne in mind that these are not evident and distinct stages, which can always be made out in practice, but that they run insensibly into one another, and often occur simultaneously, or nearly so, in rapid labor. They may be described as: 1. *Flexion.* 2. *First movement of descent.* 3. *Levelling or adjusting movement.* 4. *Rotation.* 5. *Second movement of descent and extension.* 6. *External rotation.*

1. *Flexion*, the first movement of the head, consists of a rotation on its bi-parietal diameter, by which the chin of the child becomes bent on

the sternum, and the occiput descends lower than the front part of the head. By this there is a clear mechanical gain of at least ½ inch, for the occipito-bregmatic diameter of the head (3½ inches) becomes substituted for the occipito-frontal (4 inches) (Fig. 89).

The movement is most marked when the pelvis is narrow, and in most cases of pelvic deformity it takes place to an extreme degree; while in unusually large and roomy pelves it occurs to a very slight extent, or not at all. The reason of this flexion is twofold. Solayres and the majority of obstetricians explain it by saying that the expulsive force is communicated to the head of the child through the vertebral column, and, inasmuch as the head is articulated much nearer the occiput than the sinciput, the resistance being equal, the former must be pushed down. This is doubtless the correct explanation of the flexion *after* the membranes are ruptured; but before that happens the ovum is practically an incompressible bag of water, which is equally compressed at all points by the uterine contractions, and is pushed downwards through the os *en masse*, the expulsive force not being transmitted through the vertebral column at all. Under such circumstances flexion is probably effected in the following way: the head being articulated nearer the occiput than the forehead, and being equally pressed upon from below by the resisting structures, the pressure is more effectual on its front part—consequently that is forced upwards, and the occiput descends. This explanation would also hold good after the rupture of the membranes, and probably both causes assist in effecting the movement under ordinary circumstances.

FIG. 89.

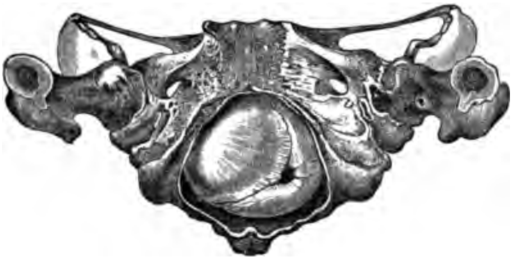


FIRST POSITION: MOVEMENT OF FLEXION.

2 and 3. The movements of *descent* and *levelling* may be described together. As soon as the head is liberated from the os uteri, it descends pretty rapidly through the pelvis, until the occiput reaches a point nearly opposite the lower part of the foramen ovale (Fig. 90), and the sinciput is opposite the second bone of the sacrum. Now a

levelling movement occurs, the anterior fontanelle comes to be more easily within reach, more on a level with the posterior, and the chin is no longer as much flexed on the sternum. This change is due to the fact that the anterior end of the ovoid experiences greater resistance than the posterior, and as soon as this resistance counterbalances and exceeds that applied to the latter, the former must descend. The right side of the head also descends more than the left, from a similar cause, so that the head becomes, as it were, slightly flexed on the right shoulder. This obliquity of the head on its transverse diameter in the lower part of the pelvis has been recently denied by Küneke,[1] who maintains that the head passes through the entire pelvis in the same direction as it enters the brim, that is, with both parietal bones on a level, so that the point of intersection of the transverse and antero-posterior diameters of the pelvis would correspond with the sagittal suture. There is, however, good reason to believe that in the lower half of the pelvic cavity the head is not truly synclitic, as Küneke describes, but that the right parietal bone is on a somewhat lower level than the left.

FIG. 90.



FIRST POSITION: OCCIPUT IN THE CAVITY OF PELVIS.

4. The movement of *rotation* is very important. By it the long diameter of the head is changed from the oblique diameter of the pelvic cavity to the antero-posterior diameter of the outlet (Fig. 91), or to a diameter nearly corresponding to it, so that the long diameter of the head is brought into relation with the longest diameter of the pelvic outlet. This alteration almost always takes place, and may be readily observed by the accoucheur who carefully watches the progress of labor. Various explanations have been given of its causes. The one most generally adopted is, that it is due to the projection inwards of the ischial spines, which narrow the transverse diameter of the pelvic outlet. As the pains force the occiput downwards, its rotation backwards is prevented by the projection of the left ischial spine, while its rotation forwards is favored by the smooth bevelled surface of the ascending ramus of the ischium. Similarly the ischial spine on the opposite side prevents the rotation forwards of the forehead, which is guided backwards to the cavity of the sacrum by the smooth surface of the sacro-ischiatic ligaments. These arrangements, therefore, give a screw-like form to

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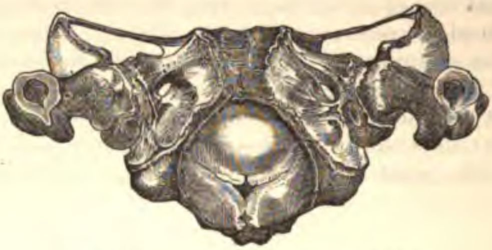
[1] Die Vier Factoren der Geburt, Berlin, 1869.

the interior of the pelvis at this point; and as the pains force the head downwards, they are effectual in imparting to it the rotatory movement which is of such importance in adapting it to the longest measurement of the outlet.

FIG. 91.



FIRST POSITION: OCCIPUT AT OUTLET OF PELVIS.

By most of the German obstetricians the influence of the ischial spines and of the smooth pelvic planes in producing rotation is not admitted. They rather refer the change of direction to the increased resistance the head meets from the posterior wall of the pelvis, and from the perinæal structures. Whichever part of the head first meets this resistance, which is much greater than that of the anterior part of the pelvis, must necessarily be pressed forwards; and as, in the large majority of cases, the anterior fontanelle descends first, it is thus pressed forwards until rotation is effected. This view has the advantage of accounting equally well for the rotation in occipito-posterior as in occipito-anterior positions, the former of which, on the more ordinarily received theory, are not quite satisfactorily explicable. It does not follow that the smooth surfaces of the pelvic planes are without influence in favoring the motion; on the contrary, they probably greatly facilitate it; but the primary cause seems more simply and effectually explained by the latter theory than by that which attributes so important an action to the ischial spines.

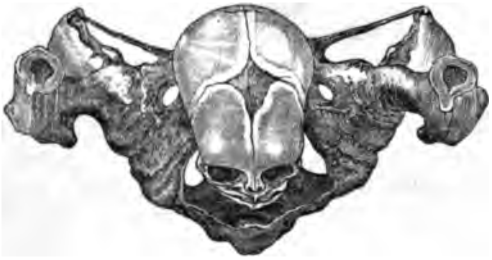
In some rare cases the head escapes rotation and reaches the perinæum still lying in the oblique diameter. Even here, however, rotation is generally effected, often suddenly, just as the head is about to pass the vulva, and it is very rarely expelled in the oblique position. The movement at this stage may be explained by the perinæum, which is attached at its sides, and grooved in its centre, and to the hollow so formed the long diameter of the head accommodates itself, and is thus rotated into the antero-posterior diameter of the outlet.

5. *Extension.*—By the process just described, the face is turned back into the hollow of the sacrum; but the head does not lie absolutely in the antero-posterior diameter of the pelvic outlet, but rather in one between it and the oblique. The occiput is still forced down by the pains, and, in consequence of its altered position, is enabled to pass between the rami of the pubes, and advances until its further descent is checked by the nape of the neck, which is pressed under and against the arch of the pubes. By this means the occiput is fixed, and, the

pains continuing, the uterine force no longer acts on the occiput, but on the anterior part of the head, which is now pushed down and separated from the sternum. This constitutes *extension*. As the head descends, the soft structures of the perinæum are stretched, and the coccyx pushed back so as to enlarge the outlet. The pains continue to distend the perinæum more and more, the head advancing and receding with each pain. As the forehead descends, the sub-occipito bregmatic, the sub-occipito frontal, and the sub-occipito-mental diameters successively present; the occiput turns more and more upwards in front of the pubes (Fig. 92), and, at last, the face sweeps over the perinæum and is born.

The mechanical cause of this movement may be readily explained. As soon as the occiput has passed under the arch of the pubes and is no longer resisted by the anterior pelvic walls, the head is subjected to the action of two forces: that of the uterine pressure, acting downwards and backwards; and that of the resistance of the posterior walls of the pelvis and the soft parts, acting almost directly forwards. The necessary result is that the head is pushed in a direction intermediate between these two opposing forces—that is, downwards and forwards in the axis of the pelvic outlet.

FIG 92.



FIRST POSITION: HEAD DELIVERED.

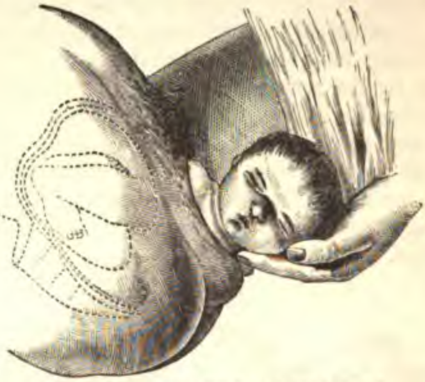
In addition to the slight obliquity which exists as regards the direct relation of the long diameter of the head to the antero-posterior diameter of the outlet at the moment of its expulsion, the head also lies somewhat obliquely in relation to its own transverse diameter, so that in the majority of cases the right parietal bone is expelled before the left.

6. *External Rotation.*—Shortly after the head is expelled, as soon as renewed uterine action commences, it may be observed to make a distinct rotatory movement, the occiput turning to the left thigh of the mother, and the face turning upwards to the right thigh (Fig. 93). The reason of this is evident. When the head descends in the right oblique diameter the shoulders lie in the opposite or left oblique diameter, and as the head rotates into the antero-posterior diameter, they are necessarily placed more nearly in the transverse. As soon as the head is expelled the shoulders are subjected to the same uterine force and pelvic resistance as the head has just been, and they are acted on in precisely the same way. Consequently they too rotate, but in the opposite direction, into the antero-posterior diameter of the outlet, or nearly so, just as the head did, and in obedience to the same mechanism; and, as they do so,

they necessarily carry the head with them, and cause its external rotation.

The two shoulders are soon expelled, the left shoulder generally the first, sweeping over the perinæum in the same manner as the face. This is, however, not always the case, and they are often expelled simultaneously, or the right shoulder may come first. The body soon follows, and the second stage of labor is completed.

FIG. 93.



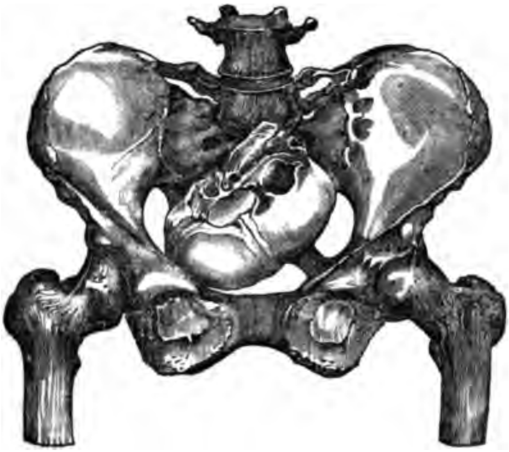
EXTERNAL ROTATION OF HEAD IN FIRST POSITION.

In the *second position* (right occipito-cotyloid) the long diameter of the head lies in the left oblique diameter of the pelvis. On making a vaginal examination, in the ordinary obstetric position, the finger, passing upwards and to the right, feels the small posterior fontanelle; downwards and to the left, it feels the anterior. The sagittal suture lies obliquely across the pelvis in the left oblique diameter. The description of the mechanism of delivery is precisely the same as in the first position, substituting the word "left" for "right." Thus the finger impinges on the left parietal bone, the occiput turns from right to left during rotation. After the birth of the head the occiput turns to the right thigh of the mother, the face to the left thigh.

In the *third position* the head enters the pelvic brim with the occiput directed backwards to the right sacro-iliac synchrondosis (Fig. 94). The posterior fontanelle is directed backwards, the anterior fontanelle forwards, and points to the left foramen ovale, while the examining finger impinges on the left parietal bone. The mechanism of delivery in these cases is of much interest. In the large majority of cases, during the progress of delivery the occiput rotates forwards along the right side of the pelvis, until it comes to lie almost in the antero-posterior diameter of the outlet, and passes under the pubic arch, the forehead passing over the perinæum. It will be seen that during part of this extensive rotation the head must lie in the second position, and the case terminates just as if it had been in the second position from the commencement of labor.

Rotation of the Occiput forwards.—How is it that this rotation is effected, and that the sinciput, occupying the position of the occiput in the first position, should not be rotated forwards to the pubes as that is? This no doubt may be explained by the fact that the uterine force transmitted through the vertebral column causes the occiput to descend lower than the sinciput, so that in most cases, in making a vaginal examination, the posterior fontanelle can be readily felt, while the anterior is high up and out of reach. The head is, therefore, extremely flexed, and so descends into the pelvic cavity, until the occiput, being now below the right ischial spine, experiences the resistance of the pelvic floor, opposite the right sacro-ischiatic ligament, by which it is directed forwards. The forehead is at this time, supposing flexion to be marked, too high to be influenced by the anterior pelvic plane. Pressure continuing, the occiput rotates forwards, the forehead passes round the left side of the pelvis, and labor is terminated as in the second position.

FIG. 94.



THIRD POSITION OF OCCIPUT, AT BRIM OF PELVIS.

The period of labor at which rotation takes place varies. In the majority of cases it does not occur until the head is on the floor of the pelvis, for it is then that resistance is most felt; but the greater the resistance, and the sooner it is felt, the sooner will rotation be produced. Hence it is more likely to occur early when the head is large and the pelvis comparatively small.

The facility with which this movement is effected obviously depends upon the complete flexion of the chin on the sternum, by which the anterior fontanelle is so elevated that its rotation backwards is not resisted by the inward projection of the left ischial spine, and the occiput is correspondingly depressed. If, however, this flexion is not complete, and the anterior fontanelle is so low as to be readily within reach of the finger, considerable difficulty is likely to be experienced. In many such cases rotation is still eventually effected, but in others it is not; and the labor is then terminated with the face to the pubes, but at the expense of considerable delay and difficulty. According to Dr. Uvedale West, of Alford, who devoted much careful study to the subject, this termination occurs in about 4 per cent. of occipito-posterior positions. When it is about to happen, the anterior fontanelle may be felt very low down, and, sometimes, even the forehead and superciliary ridges. The uterine force pushes down the occiput, the sinciput being fixed behind the pubes, which it obviously cannot pass under, as does the occiput in the first position. The sinciput, therefore, becomes more flexed and pushed upwards, while the resistance of the pelvic floor directs the occiput forwards. The perinæum now becomes enormously distended by the back part of the head, and is in great danger of laceration. The occiput is eventually, but not without much difficulty, expelled. A process of extension now occurs, the nape of the neck being fixed, as it were, against the centre of the perinæum, the expelling force now acting on the forehead, and producing rotation of the head on its transverse axis. The forehead and face are thus protruded, and the body follows without difficulty.

It is said that in a few exceptional cases, where the anterior fontanelle is much depressed, the labor may terminate by the conversion of the presentation into one of the face, the head rotating on its transverse axis, the forehead passing to the posterior part of the pelvis, and the chin emerging under the perinæum. It is obvious, however, that this change can only occur when the head is unusually small, and it must of necessity be extremely rare.

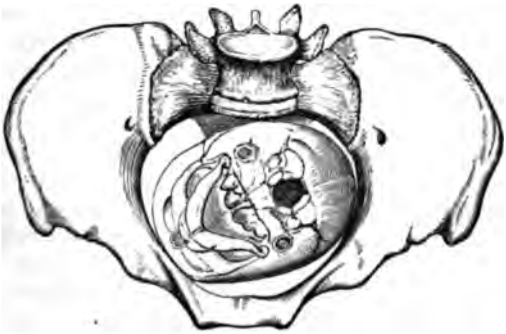
Reference has already been made to Naegele's views as to the rarity of the second position, and to his opinion that cases in which the occiput was found to point to the right foramen ovale were only transitional stages in the rotation of occipito-posterior positions. It is obvious that such an assumption is unwarrantable, unless the case has been watched from the very commencement of labor. Many perfectly qualified observers have arrived at the conclusion that second positions are far more common than Naegele supposed; and in the table already quoted it will be seen that while Murphy estimates the second and third as being equally frequent, Swayne believes the second to be much more common than the third. It is probable that the weight of Naegele's authority has induced many observers to classify second positions as third positions in which partial rotation has already been accomplished. My own experience would certainly lead me to think that second positions are very far from uncommon. The question, however, must be considered to be in abeyance, until further observations by competent authorities enable us to decide it conclusively.

The *fourth position* is just as much the reverse of the second as the third is of the first. The occiput points to the left (Fig. 95) sacro-iliac synchondrosis, and the finger impinges on the right parietal bone. The mechanism is precisely the same as in the third position, the rotation taking place from left to right.

The *formation of the caput succedaneum* has been already alluded to. This term is applied to the œdematous swelling which forms on the head and is produced by effusion from the obstruction of the venous circulation caused by the pressure to which the head is subjected. It follows that the size of the swelling is in direct proportion to the length of the labor. In rapid deliveries, in which the head is forced through the pelvis quickly, it is scarcely, if at all, developed; while after protracted labors it is large and distinct, and may obscure the diagnosis of the position, by preventing the sutures and fontanelles being felt. Its situation varies according to the position of the head: thus, in the first and fourth positions it forms on the right parietal bone, in the second and third on the left; and we may, therefore, verify, by inspection of its site, the accuracy of our diagnosis.

An ordinary mistake which has been made by obstetricians is to regard the caput succedaneum as formed at the point where the head has been most subjected to pressure; while in fact it forms on that part which is most unsupported by the maternal structures, and where the swelling may consequently most readily occur. Therefore, in the early stages of the labor it always forms on the part of the head which lies in the circle of the os uteri; while in subsequent stages it forms on that which lies in the axis of the vaginal canal, and eventually is most prominent on the part that is first expelled from the vulva.

FIG. 95.



FOURTH POSITION OF OCCIPUT AT PELVIC BRIM.

A few words may be said as to the alteration in the form of the fœtal head which occurs in tedious labors, and results from the moulding which it has undergone in its passage through the pelvis. The smaller the pelvis, and the greater the pressure applied to the head during delivery, the more marked this is. The result is, that in vertex presentations the occipito-mental and occipito-frontal diameters are elongated to the extent of an inch, or even more, while the transverse diameters are lessened, from compression of the parietal bones. This moulding is of unquestionable value in facilitating the birth of the child. The amount of apparent deformity is very considerable, and may even give rise to some anxiety. It is well to remember, therefore, that it is always transient, and that in a few hours, or days at most, the elasticity of the soft cranial bones causes them to resume their natural form. The caput succedaneum also disappears rapidly: therefore no amount of deformity from either of these causes need give rise to anxiety, or calls for any treatment.

CHAPTER III.

MANAGEMENT OF NATURAL LABOR.

ALTHOUGH labor is a strictly physiological function, and, in a large majority of cases, might no doubt be safely accomplished without assistance from the accoucheur, still, medical aid, properly given, is always of value in facilitating the process, and is often absolutely essential for the safety of the mother and child.

Preparatory Treatment.—The management of the pregnant woman before delivery is a point which should always receive the attention of the medical attendant, since it is of consequence that the labor should come on when she is in as good a state of health as possible. For this purpose ordinary hygienic precautions should never be neglected in the latter months of gestation. The patient should take regular and gentle exercise, short of fatigue, and, if the weather permit, should spend as much of her time as possible in the open air. Hot rooms, late hours, and excitement of all kinds should be strictly avoided. The diet should be simple, nutritious, and unstimulating. The state of the bowels should be particularly attended to. During the few days preceding labor, the descent of the uterus often causes pressure on the rectum, and prevents its evacuation. Hence it is customary to prescribe occasional gentle aperients, such as small doses of castor-oil, for a few days before the expected period of delivery. Some caution, however, is necessary, as it is certainly not very uncommon for labor to be determined rather sooner than was anticipated, in consequence of the irritation of too large a purgative dose. The state of the bowels should always be inquired into at the commencement of labor, and, if there be any reason to suspect that they are loaded, a copious enema should be administered. This is always a proper precaution to take, for a loaded rectum is a common cause of irregular and ineffective uterine action; and even when it does not produce this result, the escape of the fæces, in consequence of pressure on the bowel during the propulsive stage, is always disagreeable both to the patient and practitioner.

The *dress of the patient during pregnancy* may be here adverted to; for much discomfort may arise, and the satisfactory progress of labor may even be interfered with, from errors in this respect.

After the uterus has risen out of the pelvis, the ordinary corset, which most women wear, is apt to produce very injurious pressure; still more so when attempts are made to conceal the increased size by tight lacing. After the fourth or fifth month, therefore, the comfort of the patient is much increased by wearing a specially constructed pair of stays, with elastic let into the sides and front, so that they accommodate themselves to the gradual increase of the figure. Such are made by all stay-makers, and should be worn whenever the circumstances of the patient permit. Failing this, it is better to avoid the use of the corset altogether, and to have as little pressure on the uterus as possible; although many women cannot do without the support to which they are accustomed. To multiparæ, especially if there be much laxity of the abdominal parietes, a well-fitting elastic abdominal belt is often a great comfort. This is constructed so that it can be tightened when the patient is walking and in the erect position, when such support is most required, and readily loosened when desired.

It is hardly necessary to insist on the necessity of the practitioner attending immediately to the first summons to the patient. It is true that he may very often be sent for long before he is actually required. But, on the other hand, it is quite impossible to foresee what may be the state of any individual case. By prompt attention he may be able to rectify a malposition, or prevent some impending catastrophe, and thus save his patient from consequences of the utmost gravity.

The practitioner should always be provided with the articles which he may require. The ordinary obstetric cases, containing one or two bottles and a catheter, such as are sold by most instrument-makers, are cumbrous and useless; while the "obstetric bags" are expensive luxuries not within the reach of all. Every one can manufacture an excellent obstetric bag for himself, at a small expense, by having compartments for holding bottles stitched on to the sides of an ordinary leather bag, such as is sold for a few shillings at any portmanteau-maker's. It is a great comfort to have at hand all that may be required, and the bag should contain chloroform, chloral, laudanum, the liquor ferri perchloridi of the Pharmacopœia, and the liquid extract of ergot. If it also contain a Higginson's syringe, a small elastic catheter, a good pair of forceps, and one or two suture needles, with some silver wire, the practitioner is provided against any ordinary contingency. Other articles that may be required, such as thread, scissors, and the like, are generally provided by the nurse or patient.

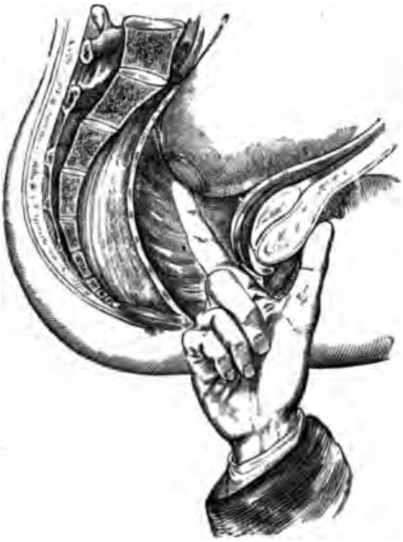
Duties on first visiting the Patient.—On arriving at the house the practitioner should have his visit announced to the patient, and he will very often find that the first effect of his presence is to arrest the pains that have been hitherto progressing rapidly, thereby affording a very conclusive proof of the influence of mental impressions on the progress of labor. If the pains be not already propulsive, it is well that he should occupy himself at first in general inquiries from the attendants as to the progress of the labor, and in seeing that all the necessary arrangements are satisfactorily carried out, so as to allow the patient time to get accustomed to his presence. If he have any choice in the matter, he should endeavor to secure a large, airy, and well-ventilated apartment for the lying-in room, as far removed as possible from without. He may also see to the bed, which should be without curtains, and prepared for the labor by having a waterproof sheeting laid under a folded blanket or sheet, on which the patient lies. These receive the discharges during labor, and can be pulled from under the patient after delivery, so as to leave the dry clothes beneath. Among the lower classes, the lying-in chamber is considered a legitimate meeting-place for numerous female friends to gossip, whose conversation is often distressing, and is certainly injurious, to a woman in the excitable condition associated with labor. The medical attendant should, therefore, insist on as much quiet as possible, and should allow no one in the room except the nurse and some one friend whose presence the patient may desire. The husband's presence must be left to the wishes of the patient. Some women like their husbands to be with them, while others prefer to be without them; and the medical attendant is bound to act in accordance with the patient's desire.

Vaginal Examination.—If pains be actually present, a vaginal examination is essential, and should not be delayed. It enables us to ascertain whether the labor has commenced or not, and whether the presentation is natural or otherwise. The pains, although apparently severe, may be altogether spurious, and labor may not have actually commenced. It is of much importance, both for our own credit and comfort, that we should be able to diagnose the true character of the pains; for if they be the so-called "false" pains, we might wait hours in fruitless expectation of progress, while delivery is still far off. The necessity of ascertaining, therefore, the actual state of affairs need not farther be insisted on.

False pains are chiefly characterized by their irregularity, sometimes coming on at short intervals, sometimes with many hours between them; they also vary much in intensity, some being very sharp and painful, while others are slight and transient. In these respects they differ from the *true* pains of the first stage, which are at first slight and short, and gradually recur with increased force and regularity. The situation of the two kinds of pains also varies, the false pains being chiefly situated in front, while the true pains are most felt in the back, and gradually shoot round towards the abdomen. Nothing short of a vaginal examination will enable us to clear up the diagnosis satisfactorily. If the labor have actually commenced, the os will be more or less dilated, and its edges thinned; while with each pain the cervix will become rigid and the membranes tense and prominent. The false pains, on the contrary, have no effect on the cervix, which remains flaccid and undilated; or, if the os be sufficiently open to admit the tip of the finger, the membranes will not become prominent during the contraction. Under such circumstances we may confidently assure the patient that the pains are false, and measures should be taken to remove the irritation which produces them. In the large majority of cases the cause of the spurious pains will be found to be some disordered state of the intestinal tract; and they will be best remedied by a gentle aperient—such as castor-oil, or the compound colocynth pill with hyoscyamus—followed by, or combined with, a sedative, such as twenty minims of laudanum or chlorodyne. Shortly after this has been administered, the false pains will die away, and not recur until true labor commences.

For a vaginal examination the patient is placed by the nurse on her left side, close to the edge of the bed, with the legs flexed on the abdomen. The practitioner, being seated by the edge of the bed, passes the index finger of the right hand, previously lubricated with lard or cold cream, up to the vulva, and gently insinuates it into the orifice of the vagina, then pushes it backwards in the axis of the vaginal outlet, and finally turns it upwards and forwards so as to more readily reach the cervix. This it may not always be easy to do, for at the commencement of labor the cervix may be so high as to be reached with difficulty, or it may be directed backwards so as to point towards the cavity of the sacrum. The exploration is often much facilitated by depressing the uterus from without, by the left hand placed on the abdomen. Our object is not only to ascertain the state of the cervix as to softness and dilatation, but also the presentation, the condition of the vagina, and the capacity of the pelvis. The examination is generally commenced during a pain, at which time it is less distressing to the patient; but, in order to be satisfactory, the finger must remain in the vagina until the pain is over, the examination being concluded in the interval between this pain and the next.

FIG. 96.



EXAMINATION DURING THE FIRST STAGE.

In head presentations the round mass of the cranium is generally at once felt through the lower part of the uterus, and then we have the satisfaction of being able to assure the patient that all is right. If the os be sufficiently dilated, we can also feel through it the occiput covered by the membranes. It is impossible at this time to make out the exact position of the head by means of the sutures and fontanelles, which are too high up to be within reach. Nor should any attempt be made to do so, for fear of prematurely rupturing the membranes. The fact that the head is presenting is all that we require to know at this stage of the labor.

The condition of the os itself, as to rigidity and dilatation, will materially assist us in forming an opinion as to the progress and probable duration of the labor; but, although the friends will certainly press for an opinion on this point, the cautious practitioner will be careful not to commit himself to a positive statement, which may so easily be falsified. It will suffice to assure the friends that everything is satisfactory, but that it is impossible to say with any certainty how rapidly, or the reverse, the case may progress.

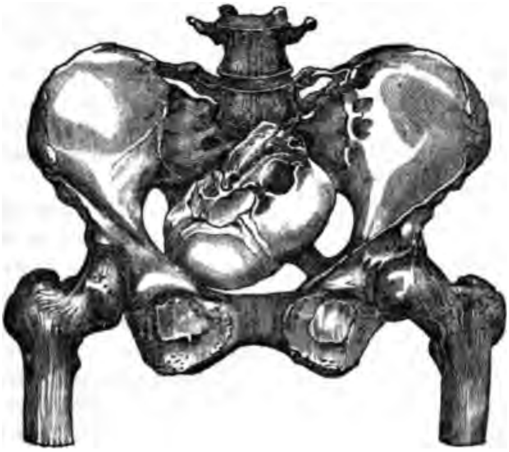
If the pains be not very frequent or strong, and the os not dilated to more than the size of a shilling, a considerable delay may be anticipated, and the presence of the medical attendant is useless. He may, therefore, safely leave the patient for an hour or more, provided he be within easy reach. It is needless to say that this should never be done unless the exact presentation be made out. If some part, other than the head, be presenting, it will probably be impossible to make it out until dilatation has progressed farther; and the practitioner must be incessantly on the watch until the nature of the case be made out, so as to be able to seize the most favorable moment for interference, should that be necessary.

Position of Patient during First Stage.—The position of the patient is a matter of some moment in the first stage. It is a decided advantage that she should not be then in a recumbent position on her side, as is usual in the second stage; for it is of importance that the expulsive force should act in such a way as to favor the descent of the head into the pelvis, *i.e.*, perpendicularly to the plane of its brim; and also that the weight of the child should operate in the same way. Therefore, the ordinary custom of allowing the patient to walk about, or to recline in a chair, is decidedly advantageous; and it will often be observed that the pains are more lingering and ineffective if she lie in bed. If the patient be a multipara, or if the abdomen be somewhat pendulous, an abdominal bandage, by supporting the uterus, will greatly favor the progress of this stage. Keeping the patient out of bed has the further advantage of preventing her being unduly anxious for the termination of the labor; and a little cheerful conversation will keep up her spirits, and obviate the mental depression which is so common. Good beef-tea may be freely administered, with a little brandy-and-water occasionally, if the patient be weak, and will be useful in supporting her strength.

Over-frequent vaginal examinations at this period should be avoided, for they serve no useful purpose, and are apt to irritate the cervix. It will be necessary, however, to ascertain the progress of the dilatation at intervals.

Artificial Rupture of the Membranes.—When once the os is fully opened, the membranes may be artificially ruptured if they have not broken spontaneously, for they no longer serve any useful purpose, and only retard the advent of the propulsive stage. This can be easily done by pressing on them, when they are rendered tense during a pain, by some pointed instrument, such as the end of a hair-pin, which is always at hand. In some cases, indeed, it is even expedient to rupture the membranes before the os is fully dilated. Thus, it not unfrequently happens, when the amount of liquor amnii is at all excessive, that the os dilates to the size of a five-shilling piece or more, but, although it is perfectly soft and flaccid, it opens up no further until the liquor amnii is evacuated, when the propulsive pains rapidly complete its dilatation. Some experience and judgment are required in the deteceffected, and that the sinciput, occupying the position of the occiput in the first position, should not be rotated forwards to the pubes as that is? This no doubt may be explained by the fact that the uterine force transmitted through the vertebral column causes the occiput to descend lower than the sinciput, so that in most cases, in making a vaginal examination, the posterior fontanelle can be readily felt, while the anterior is high up and out of reach. The head is, therefore, extremely flexed, and so descends into the pelvic cavity, until the occiput, being now below the right ischial spine, experiences the resistance of the pelvic floor, opposite the right sacro-ischiatic ligament, by which it is directed forwards. The forehead is at this time, supposing flexion to be marked, too high to be influenced by the anterior pelvic plane. Pressure continuing, the occiput rotates forwards, the forehead passes round the left side of the pelvis, and labor is terminated as in the second position.

FIG. 94.



THIRD POSITION OF OCCIPUT, AT BRIM OF PELVIS.

The period of labor at which rotation takes place varies. In the majority of cases it does not occur until the head is on the floor of the pelvis, for it is then that resistance is most felt; but the greater the resistance, and the sooner it is felt, the sooner will rotation be produced. Hence it is more likely to occur early when the head is large and the pelvis comparatively small.

The facility with which this movement is effected obviously depends upon the complete flexion of the chin on the sternum, by which the anterior fontanelle is so elevated that its rotation backwards is not resisted by the inward projection of the left ischial spine, and the occiput is correspondingly depressed. If, however, this flexion is not complete, and the anterior fontanelle is so low as to be readily within reach of the finger, considerable difficulty is likely to be experienced. In many such cases rotation is still eventually effected, but in others it is not; and the labor is then terminated with the face to the pubes, but at the expense of considerable delay and difficulty. According to Dr. Uvedale West, to become swollen by the pressure to which it is subjected, and then to retard the progress of the labor. There can be no reasonable objection to attempting to prevent this cause of delay by pressing on the incarcerated lip during the interval of the pains, so as to push it above the head, and maintain it there during the pains, until the head descends below it. This manœuvre, if done judiciously and without any undue roughness or force, is certainly not liable to be attended by any of the evil consequences which many obstetricians have attributed to it; it is indeed a matter of common sense that the injury to the cervix is likely to be less if it be pushed gently out of the way, than if it be left to be tightly jammed for hours between the presenting part and the bony pelvis. This mode of assistance is very different from the digital dilatation of a rigid cervix, which was formerly much practised, especially in Edinburgh, in consequence of the recommendation of Hamilton, and which was properly objected to by the great majority of obstetricians.

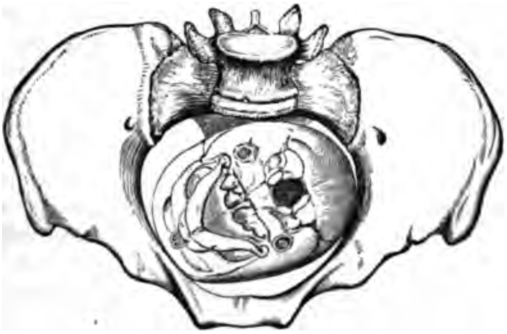
If the pains be producing satisfactory progress, no farther interference is required. The medical attendant should, however, see that the bladder is evacuated; and if it have not been so for some hours, it may be necessary to draw off the urine by the catheter. Whenever the labor is lengthy, he should occasionally practise auscultation, so as to satisfy himself that the fœtal circulation is being satisfactorily carried on.

The *regulation of the bearing-down efforts* at this time is of importance. It is common for the nurse to urge the patient to help herself by straining, and it is certain that by voluntary exertion of this kind she can materially increase the action of the accessory muscles of parturition. If the pains be strong, and the labor promise to be rapid, such voluntary exertions are not likely to be prejudicial. On the other hand, if the case be progressing slowly, they only unnecessarily fatigue the patient, and should be discouraged. When the perinæum is distended, we may even find it advisable to urge the patient to cease all voluntary effort, and to cry out, for the express purpose of lessening the tension to which the perinæum is subjected. This is the stage in which anæsthesia is most serviceable; but its employment must be separately discussed.

Distension of the Perinæum.—As the head descends more and more, the perinæum becomes distended, and there is considerable difference of opinion amongst accoucheurs as to the management of the case at this time. In most obstetric works the practitioner is advised to endeavor to prevent laceration by the manœuvre that is described as "supporting the perinæum." By this is meant, laying the palm of the hand on the distended structures, and pressing firmly upon them during the acme of the pain, with the view of mechanically preventing their tearing. There can be little doubt that this, or some modification of it, is the practice now followed by the large majority of practitioners. Of late years the evil effects likely to follow it have been specially dwelt upon by Graily Hewitt, Leishman, Goodell, and other writers, who maintain that by pressure exerted in this fashion we not only fail to prevent, but actually favor, laceration, in consequence of the pressure producing increased uterine action, just at the time when forcible distension of the perinæum is likely to be hurtful. Therefore some hold that the peri-of the labor. In rapid deliveries, in which the head is forced through the pelvis quickly, it is scarcely, if at all, developed; while after protracted labors it is large and distinct, and may obscure the diagnosis of the position, by preventing the sutures and fontanelles being felt. Its situation varies according to the position of the head: thus, in the first and fourth positions it forms on the right parietal bone, in the second and third on the left; and we may, therefore, verify, by inspection of its site, the accuracy of our diagnosis.

An ordinary mistake which has been made by obstetricians is to regard the caput succedaneum as formed at the point where the head has been most subjected to pressure; while in fact it forms on that part which is most unsupported by the maternal structures, and where the swelling may consequently most readily occur. Therefore, in the early stages of the labor it always forms on the part of the head which lies in the circle of the os uteri; while in subsequent stages it forms on that which lies in the axis of the vaginal canal, and eventually is most prominent on the part that is first expelled from the vulva.

FIG. 95.



FOURTH POSITION OF OCCIPUT AT PELVIC BRIM.

A few words may be said as to the alteration in the form of the fœtal head which occurs in tedious labors, and results from the moulding which it has undergone in its passage through the pelvis. The smaller the pelvis, and the greater the pressure applied to the head during delivery, the more marked this is. The result is, that in vertex presentations the occipito-mental and occipito-frontal diameters are elongated to the extent of an inch, or even more, while the transverse diameters are lessened, from compression of the parietal bones. This moulding is of unquestionable value in facilitating the birth of the child. The amount of apparent deformity is very considerable, and may even give rise to some anxiety. It is well to remember, therefore, that it is always transient, and that in a few hours, or days at most, the elasticity of the soft cranial bones causes them to resume their natural form. The caput succedaneum also disappears rapidly: therefore no amount of deformity from either of these causes need give rise to anxiety, or calls for any treatment.

CHAPTER III.

MANAGEMENT OF NATURAL LABOR.

ALTHOUGH labor is a strictly physiological function, and, in a large majority of cases, might no doubt be safely accomplished without assistance from the accoucheur, still, medical aid, properly given, is always of value in facilitating the process, and is often absolutely essential for the safety of the mother and child.

Preparatory Treatment.—The management of the pregnant woman before delivery is a point which should always receive the attention of the medical attendant, since it is of consequence that the labor should come on when she is in as good a state of health as possible. For this purpose ordinary hygienic precautions should never be neglected in the latter months of gestation. The patient should take regular and gentle exercise, short of fatigue, and, if the weather permit, should spend as much of her time as possible in the open air. Hot rooms, late hours, and excitement of all kinds should be strictly avoided. The diet should be simple, nutritious, and unstimulating. The state of the bowels should be particularly attended to. During the few days preceding labor, the descent of the uterus often causes pressure on the rectum, and prevents its evacuation. Hence it is customary to prescribe occasional gentle aperients, such as small doses of castor-oil, for a few days before the expected period of delivery. Some caution, however, is necessary, as it is certainly not very uncommon for labor to be determined rather sooner than was anticipated, in consequence of the irritation of too large a purgative dose. The state of the bowels should always be inquired into at the commencement of labor, and, if there be any reason to suspect that they are loaded, a copious enema should be administered. This is always a proper precaution to take, for a loaded rectum is a common cause of irregular and ineffective uterine action; and even when it does not produce this result, the escape of the fæces, in consequence of pressure on the bowel during the propulsive stage, is always disagreeable both to the patient and practitioner.

The *dress of the patient during pregnancy* may be here adverted to; for much discomfort may arise, and the satisfactory progress of labor may even be interfered with, from errors in this respect.

After the uterus has risen out of the pelvis, the ordinary corset, which most women wear, is apt to produce very injurious pressure; still more so when attempts are made to conceal the increased size by tight lacing. After the fourth or fifth month, therefore, the comfort of the patient is much increased by wearing a specially constructed pair of stays, with elastic let into the sides and front, so that they accommodate themselves to the gradual increase of the figure. Such are made by all stay-makers, and should be worn whenever the circumstances of the patient permit. Failing this, it is better to avoid the use of the corset altogether, and to have as little pressure on the uterus as possible; although many women cannot do without the support to which they are accustomed. To multiparæ, especially if there be much laxity of the abdominal parietes, a well-fitting elastic abdominal belt is often a great comfort. This is constructed so that it can be tightened when the patient is walking and in the erect position, when such support is most required, and readily loosened when desired.

It is hardly necessary to insist on the necessity of the practitioner attending immediately to the first summons to the patient. It is true that he may very often be sent for long before he is actually required. But, on the other hand, it is quite impossible to foresee what may be the state of any individual case. By prompt attention he may be able to rectify a malposition, or prevent some impending catastrophe, and thus save his patient from consequences of the utmost gravity.

The practitioner should always be provided with the articles which he may require. The ordinary obstetric cases, containing one or two bottles and a catheter, such as are sold by most instrument-makers, are cumbrous and useless; while the "obstetric bags" are expensive luxuries not within the reach of all. Every one can manufacture an excellent obstetric bag for himself, at a small expense, by having compartments for holding bottles stitched on to the sides of an ordinary leather bag, such as is sold for a few shillings at any portmanteau-maker's. It is a great comfort to have at hand all that may be required, and the bag should contain chloroform, chloral, laudanum, the liquor ferri perchloridi of the Pharmacopœia, and the liquid extract of ergot. If it also contain a Higginson's syringe, a small elastic catheter, a good pair of forceps, and one or two suture needles, with some silver wire, the practitioner is provided against any ordinary contingency. Other articles that may be required, such as thread, scissors, and the like, are generally provided by the nurse or patient.

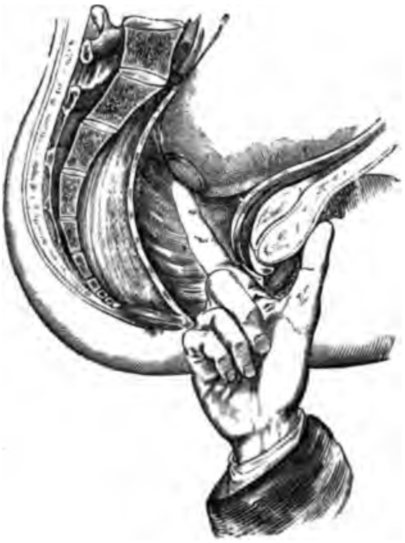
Duties on first visiting the Patient.—On arriving at the house the practitioner should have his visit announced to the patient, and he will very often find that the first effect of his presence is to arrest the pains that have been hitherto progressing rapidly, thereby affording a very conclusive proof of the influence of mental impressions on the progress of labor. If the pains be not already propulsive, it is well that he should occupy himself at first in general inquiries from the attendants as to the progress of the labor, and in seeing that all the necessary arrangements are satisfactorily carried out, so as to allow the patient time to get accustomed to his presence. If he have any choice in the matter, he should endeavor to secure a large, airy, and well-ventilated apartment for the lying-in room, as far removed as possible from without. He may also see to the bed, which should be without curtains, and prepared for the labor by having a waterproof sheeting laid under a folded blanket or sheet, on which the patient lies. These receive the discharges during labor, and can be pulled from under the patient after delivery, so as to leave the dry clothes beneath. Among the lower classes, the lying-in chamber is considered a legitimate meeting-place for numerous female friends to gossip, whose conversation is often distressing, and is certainly injurious, to a woman in the excitable condition associated with labor. The medical attendant should, therefore, insist on as much quiet as possible, and should allow no one in the room except the nurse and some one friend whose presence the patient may desire. The husband's presence must be left to the wishes of the patient. Some women like their husbands to be with them, while others prefer to be without them; and the medical attendant is bound to act in accordance with the patient's desire.

Vaginal Examination.—If pains be actually present, a vaginal examination is essential, and should not be delayed. It enables us to ascertain whether the labor has commenced or not, and whether the presentation is natural or otherwise. The pains, although apparently severe, may be altogether spurious, and labor may not have actually commenced. It is of much importance, both for our own credit and comfort, that we should be able to diagnose the true character of the pains; for if they be the so-called "false" pains, we might wait hours in fruitless expectation of progress, while delivery is still far off. The necessity of ascertaining, therefore, the actual state of affairs need not farther be insisted on.

False pains are chiefly characterized by their irregularity, sometimes coming on at short intervals, sometimes with many hours between them; they also vary much in intensity, some being very sharp and painful, while others are slight and transient. In these respects they differ from the *true* pains of the first stage, which are at first slight and short, and gradually recur with increased force and regularity. The situation of the two kinds of pains also varies, the false pains being chiefly situated in front, while the true pains are most felt in the back, and gradually shoot round towards the abdomen. Nothing short of a vaginal examination will enable us to clear up the diagnosis satisfactorily. If the labor have actually commenced, the os will be more or less dilated, and its edges thinned; while with each pain the cervix will become rigid and the membranes tense and prominent. The false pains, on the contrary, have no effect on the cervix, which remains flaccid and undilated; or, if the os be sufficiently open to admit the tip of the finger, the membranes will not become prominent during the contraction. Under such circumstances we may confidently assure the patient that the pains are false, and measures should be taken to remove the irritation which produces them. In the large majority of cases the cause of the spurious pains will be found to be some disordered state of the intestinal tract; and they will be best remedied by a gentle aperient—such as castor-oil, or the compound colocynth pill with hyoscyamus—followed by, or combined with, a sedative, such as twenty minims of laudanum or chlorodyne. Shortly after this has been administered, the false pains will die away, and not recur until true labor commences.

For a vaginal examination the patient is placed by the nurse on her left side, close to the edge of the bed, with the legs flexed on the abdomen. The practitioner, being seated by the edge of the bed, passes the index finger of the right hand, previously lubricated with lard or cold cream, up to the vulva, and gently insinuates it into the orifice of the vagina, then pushes it backwards in the axis of the vaginal outlet, and finally turns it upwards and forwards so as to more readily reach the cervix. This it may not always be easy to do, for at the commencement of labor the cervix may be so high as to be reached with difficulty, or it may be directed backwards so as to point towards the cavity of the sacrum. The exploration is often much facilitated by depressing the uterus from without, by the left hand placed on the abdomen. Our object is not only to ascertain the state of the cervix as to softness and dilatation, but also the presentation, the condition of the vagina, and the capacity of the pelvis. The examination is generally commenced during a pain, at which time it is less distressing to the patient; but, in order to be satisfactory, the finger must remain in the vagina until the pain is over, the examination being concluded in the interval between this pain and the next.

FIG. 96.



EXAMINATION DURING THE FIRST STAGE.

In head presentations the round mass of the cranium is generally at once felt through the lower part of the uterus, and then we have the satisfaction of being able to assure the patient that all is right. If the os be sufficiently dilated, we can also feel through it the occiput covered by the membranes. It is impossible at this time to make out the exact position of the head by means of the sutures and fontanelles, which are too high up to be within reach. Nor should any attempt be made to do so, for fear of prematurely rupturing the membranes. The fact that the head is presenting is all that we require to know at this stage of the labor.

The condition of the os itself, as to rigidity and dilatation, will materially assist us in forming an opinion as to the progress and probable duration of the labor; but, although the friends will certainly press for an opinion on this point, the cautious practitioner will be careful not to commit himself to a positive statement, which may so easily be falsified. It will suffice to assure the friends that everything is satisfactory, but that it is impossible to say with any certainty how rapidly, or the reverse, the case may progress.

If the pains be not very frequent or strong, and the os not dilated to more than the size of a shilling, a considerable delay may be anticipated, and the presence of the medical attendant is useless. He may, therefore, safely leave the patient for an hour or more, provided he be within easy reach. It is needless to say that this should never be done unless the exact presentation be made out. If some part, other than the head, be presenting, it will probably be impossible to make it out until dilatation has progressed farther; and the practitioner must be incessantly on the watch until the nature of the case be made out, so as to be able to seize the most favorable moment for interference, should that be necessary.

Position of Patient during First Stage.—The position of the patient is a matter of some moment in the first stage. It is a decided advantage that she should not be then in a recumbent position on her side, as is usual in the second stage; for it is of importance that the expulsive force should act in such a way as to favor the descent of the head into the pelvis, *i.e.*, perpendicularly to the plane of its brim, and also that the weight of the child should operate in the same way. Therefore, the ordinary custom of allowing the patient to walk about, or to recline in a chair, is decidedly advantageous; and it will often be observed that the pains are more lingering and ineffective if she lie in bed. If the patient be a multipara, or if the abdomen be somewhat pendulous, an abdominal bandage, by supporting the uterus, will greatly favor the progress of this stage. Keeping the patient out of bed has the further advantage of preventing her being unduly anxious for the termination of the labor; and a little cheerful conversation will keep up her spirits, and obviate the mental depression which is so common. Good beef-tea may be freely administered, with a little brandy-and-water occasionally, if the patient be weak, and will be useful in supporting her strength.

Over-frequent vaginal examinations at this period should be avoided, for they serve no useful purpose, and are apt to irritate the cervix. It will be necessary, however, to ascertain the progress of the dilatation at intervals.

Artificial Rupture of the Membranes.—When once the os is fully opened, the membranes may be artificially ruptured if they have not broken spontaneously, for they no longer serve any useful purpose, and only retard the advent of the propulsive stage. This can be easily done by pressing on them, when they are rendered tense during a pain, by some pointed instrument, such as the end of a hair-pin, which is always at hand. In some cases, indeed, it is even expedient to rupture the membranes before the os is fully dilated. Thus, it not unfrequently happens, when the amount of liquor amnii is at all excessive, that the os dilates to the size of a five-shilling piece or more, but, although it is perfectly soft and flaccid, it opens up no further until the liquor amnii is evacuated, when the propulsive pains rapidly complete its dilatation. Some experience and judgment are required in the detection of such cases, for if we evacuated the liquor amnii prematurely the pressure of the head on the cervix might produce irritation, and seriously prolong the labor. This manœuvre is most likely to be useful when the pains are strong and the os perfectly flaccid, but when the membranes do not protrude through the os and produce further dilatation.

It is sometimes not easy to ascertain whether the membranes are ruptured or not. This is most likely to be the case when the head is low down, and the amount of liquor amnii is so small that the pouch does not become prominent during the pains. A little care, however, will enable us, if the membranes be ruptured, to feel the rugosities of the scalp covered with hair, and to distinguish it from the smooth polished surface of the membranes.

Treatment of the Propulsive Stage.—After the evacuation of the liquor amnii there is generally a lull in the progress of the labor, the pains, however, soon recurring with increased force and frequency, and propelling the head through the pelvic cavity. The change in the character of the pains is soon appreciated by the bearing-down efforts by which they are accompanied, as well as by their increased length and intensity.

Position of the Patient.—It is now advisable that the patient be placed in bed; and in this country it is usual for her to lie on the left side, with her nates parallel to the edge of the bed, and her body lying across it. This is the established obstetric position in England, and it would be useless to attempt to insist on any other, even if it were advisable. Although the dorsal position is preferred on the Continent and in America, it is difficult to see wherein its advantages consist. It certainly leads to unnecessary exposure of the person, and it is, on the whole, less easy to reach the patient, so placed, for the necessary manipulations. Moreover, the dorsal position increases the risk of laceration of the perinæum, by bringing the weight of the child's head to bear more directly upon it. Thus, Schroeder found that lacerations occurred in 37.6 per cent. of cases delivered on the back, as against 24.4 per cent. in other positions.

The patient usually remains in bed during the whole of this stage, and it is customary for the nurse to tie to the foot of the bed a jack-towel, which is laid hold of and used as a support in making bearing-down efforts. If the pains be few and far between, and the patient finds it more comfortable to get up occasionally, there is no reason why she should not do so. On the contrary, as we shall subsequently see in treating of lingering labor, the pains under such circumstances are often increased in the sitting posture, in consequence of the weight of the child producing increased pressure on the nerves of the vagina.

At this time vaginal examination, which should be more frequently repeated than in the first stage, enables us to ascertain precisely the position of the head, by means of the sutures and fontanelles, as well as to watch its progress.

It not unfrequently happens that the head descends into the pelvis, even to its floor, without the os having entirely disappeared. The anterior lip especially is apt to get caught between the head and pubes, to become swollen by the pressure to which it is subjected, and then to retard the progress of the labor. There can be no reasonable objection to attempting to prevent this cause of delay by pressing on the incarcerated lip during the interval of the pains, so as to push it above the head, and maintain it there during the pains, until the head descends below it. This manœuvre, if done judiciously and without any undue roughness or force, is certainly not liable to be attended by any of the evil consequences which many obstetricians have attributed to it; it is indeed a matter of common sense that the injury to the cervix is likely to be less if it be pushed gently out of the way, than if it be left to be tightly jammed for hours between the presenting part and the bony pelvis. This mode of assistance is very different from the digital dilatation of a rigid cervix, which was formerly much practised, especially in Edinburgh, in consequence of the recommendation of Hamilton, and which was properly objected to by the great majority of obstetricians.

If the pains be producing satisfactory progress, no farther interference is required. The medical attendant should, however, see that the bladder is evacuated; and if it have not been so for some hours, it may be necessary to draw off the urine by the catheter. Whenever the labor is lengthy, he should occasionally practise auscultation, so as to satisfy himself that the fœtal circulation is being satisfactorily carried on.

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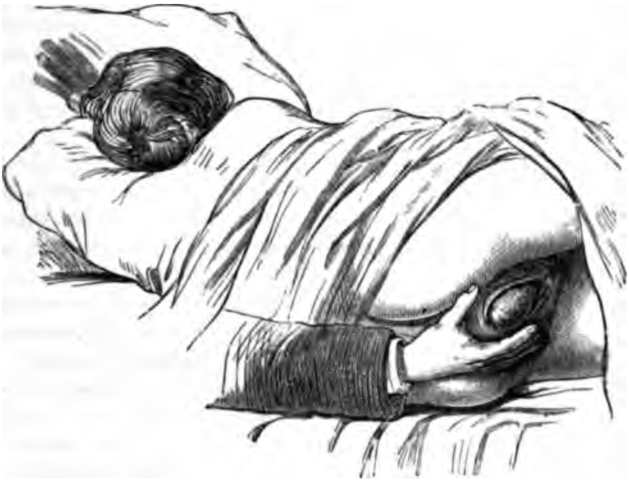
Distension of the Perinæum.—As the head descends more and more, the perinæum becomes distended, and there is considerable difference of opinion amongst accoucheurs as to the management of the case at this time. In most obstetric works the practitioner is advised to endeavor to prevent laceration by the manœuvre that is described as "supporting the perinæum." By this is meant, laying the palm of the hand on the distended structures, and pressing firmly upon them during the acme of the pain, with the view of mechanically preventing their tearing. There can be little doubt that this, or some modification of it, is the practice now followed by the large majority of practitioners. Of late years the evil effects likely to follow it have been specially dwelt upon by Graily Hewitt, Leishman, Goodell, and other writers, who maintain that by pressure exerted in this fashion we not only fail to prevent, but actually favor, laceration, in consequence of the pressure producing increased uterine action, just at the time when forcible distension of the perinæum is likely to be hurtful. Therefore some hold that the perinæum ought to be left entirely alone, and that the head should be allowed gradually to distend it, without any assistance on the part of the practitioner.

Much error may be traced to a misconception of what is required. The term "supporting the perinæum" conveys an unquestionably erroneous idea, and it is certain that no one can prevent laceration by mechanical support. If the term "relaxation of the perinæum" were employed, we should have a far more accurate idea of what should be aimed at, and if this be borne in mind, I think it cannot be questioned that nature may be most usefully assisted at this stage.

Dr. Goodell, of Philadelphia, has specially studied this subject, and has recommended a method, the object of which is to relax the perinæum. His advice is, that one or two fingers of the left hand should be inserted into the rectum, by which the perinæum should be hooked up and pulled forward over the head, towards the pubes, the thumb of the same hand being placed on the advancing head, so as to restrain its progress if needful. I have followed this plan frequently, and believe that it admirably answers its purpose, especially when the perinæum is greatly distended and laceration is threatened. It must be admitted that the insertion of the fingers into the anal orifice, in the manner recommended, is repugnant both to the practitioner and patient; and the same result can be obtained in a less unpleasant way. I mention it, however, to show what it is that the practitioner must aim at. If, when the head is distending the perinæum greatly, the thumb and fore-finger of the right hand are placed along its sides, it can be pushed gently forwards over the head at the height of the pain, while the tips of the fingers may at the same time press upon the advancing vertex, so as to retard its progress if advisable (Fig. 97). By this means the sudden

FIG. 97.



MODE OF EFFECTING RELAXATION OF THE PERINÆUM.

and forcible stretching of the perineal structures is prevented, and the chance of laceration reduced to a minimum, while nature's mode of relaxing the tissues, by dilatation of the anal orifice, is favored. This is very different from the mechanical support that is usually recommended, and the less pressure that is applied directly to the perinæum the better. Nor is it either needful or advisable to sit by the patient with the hand applied to the perinæum for hours, as is so often practised. Time should be given for the gradual distension of the tissues by the alternate advance and recession of the head, and we need only intervene to assist relaxation when the stretching has reached its height and the head is about to be expelled. A napkin may be interposed between the hand and the skin, for the purpose of cleanliness. Should the perinæum be excessively tough and resistant, assiduous fomentation with a hot sponge may be resorted to, and will be of some service in promoting relaxation.

Incision of the Perinæum.—When the tension is so great that laceration seems inevitable, it is generally recommended that a slight incision should be made on each side of the central raphé, with the view of preventing spontaneous laceration. This may no doubt be done with perfect safety, but I question if it is likely to be of use. The idea is that an incised wound is likely to heal more readily than a lacerated one. When, however, a distended perinæum ruptures, its structures are so thinned that the tear is always linear; and, as a matter of fact, the edges of the tear are always as clean, and as closely in apposition, as if the cut had been made with a knife. Moreover, the laceration invariably heals perfectly, if only the edges be brought into contact at once with one or two metallic sutures. I believe, therefore, that Goodell is right in stating that incision of the perinæum is rarely, if ever, necessary, unless it is hardened by previous cicatrization. In almost all first labors the fourchette is torn, but requires no treatment of any kind. In some cases, do what we will, more or less laceration occurs, and the perinæum should always be examined after the expulsion of the child, to see if any tear has taken place.

Treatment of Lacerations.—If it has given way to any extent, I believe that it is good practice to insert one or two interrupted sutures of silver wire at once. Immediately after delivery the sensibility of the tissues is deadened by the distension to which they have been subjected, and the sutures can be inserted with little or no pain. It is quite true that lacerations of an inch or less will generally heal perfectly well of themselves; but this is not invariably the case, while healing almost certainly follows if the edges be brought together at once. In the severer forms of laceration, extending back to, or even through, the sphincter, the precaution is all the more necessary, and a subsequent operation of gravity may in this way be avoided. The sutures can be removed without difficulty in a week or so, when complete adhesion has taken place.

Expulsion of the Child.—The head, when expelled, should be received in the palm of the right hand, while the left hand is placed upon the abdomen to follow down the uterus as it contracts and expels the body. There is generally some little delay after the expulsion of the head, and we should now see if the cord surround the neck, and, if it do so, it should be drawn over the head. The expulsion of the body should be left entirely to the uterine contractions. If there be undue delay, we may endeavor to excite uterine action by friction on the fundus, and it will rarely happen that sufficient contraction does not now come on. If we display undue haste in withdrawing the body, we run the risk of emptying the uterus while its tissues are relaxed, and so favor hemorrhage. If, however, there seem serious danger of the child being asphyxiated, its expulsion may be favored by gently passing the forefinger of each hand within the axillæ, and using traction; but it is only very exceptionally that such interference is required.

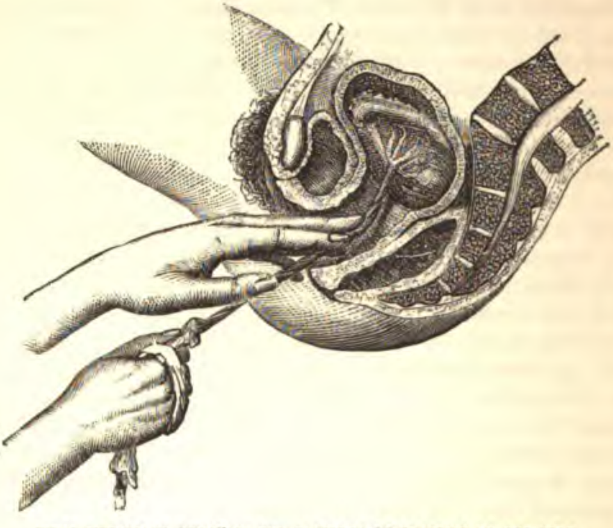
As the uterus contracts, it should be carefully followed down through the abdominal parietes by the left hand, which should grasp it as the body is expelled, with the view of seeing that it is efficiently contracted. This is a point of vital importance in preventing hemorrhage, which will presently be more especially considered.

Ligature of the Cord.—As soon as the child cries, we may proceed to tie and separate the cord. For this purpose the nurse usually provides ligatures composed of several strands of whity-brown thread; but tape, or any other suitable material, may be employed. It is important, especially if the cord be very thick and gelatinous, to see that it is thoroughly compressed, so that the vessels are obliterated; otherwise secondary hemorrhage might occur. The cord is tied about an inch and a half from the child, and it is usual, though of course not essential, to place a second ligature about two inches nearer the placental extremity of the cord. The latter is, perhaps, of some use by retaining the blood, and thus increasing the size of the placenta and favoring its more ready expulsion by uterine contraction. The cord is then divided with scissors between the ligatures, the child wrapped up in flannel, and given to the nurse, or a bystander, to hold, while the attention of the practitioner is concentrated on the mother, with a view to the proper management of the third stage of labor.

There is unquestionably no period of labor where skilled management is more important, and none in which mistakes are more frequently made. By proper care at this time, the risk of post-partum hemorrhage is reduced to a minimum, the efficient contraction of the uterus is secured, the amount and intensity of after-pains are lessened, and the safety and comfort of the patient greatly promoted. Moreover, the general practice as to the management of this stage is opposed to the natural mechanism of placental expulsion, and is far from being well adapted to secure the important objects which we ought to have in view. Let us see what is the practice usually recommended and followed, and then we shall be in a position to understand in what respects it is erroneous. For this purpose I cannot do better than copy the directions contained in one of our most deservedly popular obstetric text-books, which undoubtedly expresses the usual practice in the management of this stage. "When the binder is applied, the patient may be allowed to rest a while, if there is no flooding; after which, *when the uterus contracts*, gentle traction may be made by the funis, to ascertain if the placenta be detached. If so, and especially if it be in the vagina, it may be removed by continuing the traction steadily in the axis of the upper outlet at first, at the same time making pressure on the uterus."[1]

Objections to Ordinary Practice.—This may fairly be taken as a sufficiently accurate description of the practice that is usually followed.[2] The objections I have to make are: (1) That it inculcates the common error of relying on the binder as a means of promoting uterine contraction, advising its application before the expulsion of the placenta; while I hold that the binder should never be applied until after the placenta is expelled, and not even then, unless we are certain that the uterus is perfectly and permanently contracted. (2) That it teaches that traction on the cord should be used as a means of withdrawing the placenta; while the uterus itself should be made to expel the afterbirth, and in nineteen cases out of twenty the finger need never be introduced into the vagina after the birth of the child, or the cord touched. This may seem an exaggerated statement to those who have accustomed themselves to the usual method of dealing with the placenta; but I feel confident that all who have learnt the method of expression of the placenta by proper manipulation of the uterus would testify to its accuracy.

FIG. 98.



USUAL METHOD OF REMOVING THE PLACENTA BY TRACTION ON THE CORD.

Expression of the Placenta.—The cardinal point to bear in mind is that the placenta should be expelled from the uterus by a *vis a tergo*, not drawn out by a *vis a fronte*. That uterine pressure after the birth of the child has been recommended by many English writers is certain, and the Dublin school especially have dwelt on its importance as a preventive of post-partum hemorrhage; but the distinct enunciation of the doctrine that the placenta should be pressed, and not drawn, out of the uterus, we owe to Credé and other German writers; and it is only of late years that this practice has become at all common. Those who have not seen placental expression practised, find it difficult to understand that in the large majority of cases the uterus may be made to expel the placenta out of the vagina; but such is unquestionably the fact. A little practice is no doubt necessary to enable us to effect this satisfactorily; but when once the knack has been learnt there is little difficulty likely to be experienced.

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[1] Churchill's Theory and Practice of Midwifery, p. 162.

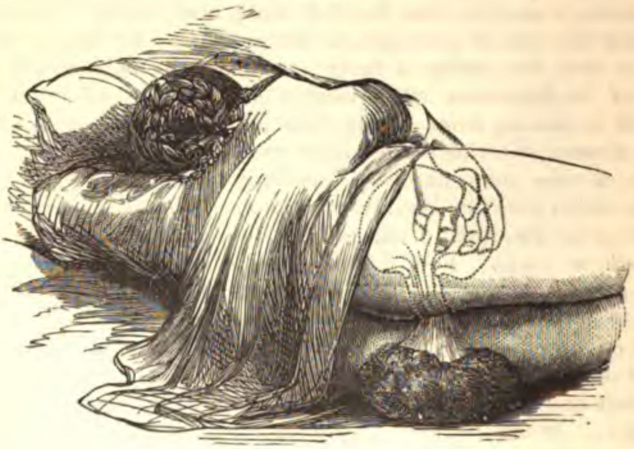
[2] This practice is farther illustrated by the annexed diagram, contained in most obstetric works, which represents the accoucheur as withdrawing the placenta by traction, and which I insert as an illustration of what ought *not* to be done (Fig. 98).

Before describing the method of placental expression, a word of caution may be said against undue haste in attempting expression of the placenta, a mistake that is often made, and which, I believe, tends to increase the risk of post-partum hemorrhage. So long as we satisfy ourselves that the uterus is fairly contracted, so as to avoid the possibility of its distension with blood, a certain delay after the birth of the child is useful, from giving time for coagula to form within the uterine sinuses, by which their open mouths are closed up. The importance of this point has been specially dwelt upon by McClintock, who lays down the rule that fifteen or twenty minutes should be allowed to elapse, after the birth of the child, before any attempt to remove the after-birth is made. This I believe to be a good and safe practical rule, as it gives ample time for the complete detachment of the placenta, and the coagulation of the blood in the uterine sinuses.

Mode of Effecting Expulsion.—During this interval the practitioner or nurse should sit by the bedside, with the hand on the uterus to secure contraction and prevent distension; but not kneading or forcibly compressing it. When we judge that a sufficient time has elapsed, we may proceed to effect expulsion. For this purpose the fundus should be grasped in the hollow of the left hand, the ulnar edge of the hand being well pressed down behind the fundus, and *when the uterus is felt to harden* strong and firm pressure should be made downwards and backwards in the axis of the pelvic brim. If this manœuvre be properly carried out, and sufficiently firm pressure made, in almost every case the uterus may be made to expel the placenta into the bed, along with any coagula that may be in its cavity (Fig. 99). The uterine surface of the placenta is generally expelled first, as is represented in the diagram, the cord being within the membranes; whereas the fœtal surface, and the root of the cord, are the parts which appear first when the placenta is removed by traction (Fig. 97). If we do not succeed at the first effort, which is rarely the case if extrusion be not attempted too soon after the birth of the child, we may wait until another contraction takes place, and then re-apply the pressure. I repeat that, after a little practice, the placenta may be entirely expelled in this way, in nineteen cases out of twenty, without even touching the cord, and the bugbear of retained placenta will cease to be a source of dread.

Management of the Membranes.—Should we fail in causing the uterus to expel the placenta, a vaginal examination may be made, and, if the placenta be found lying entirely in the vagina, it may be carefully withdrawn. If, however, the cord can be traced up through the os, showing that the placenta is still within the uterine cavity, we must again resort to pressure to effect its expulsion, and not attempt to withdraw it by traction. Such cases may fairly be classed as retained placenta, but they should be very rarely met with, and are discussed elsewhere. When they do often occur in the hands of the same practitioner, it is fair to conclude that he has not properly acquired the art of managing this stage of labor. Generally speaking, the placenta should be expelled within twenty minutes after the birth of the child; but no doubt, in the large majority of cases, expulsion might be effected sooner were it advisable to attempt it.

FIG. 99.



ILLUSTRATING EXPRESSION OF THE PLACENTA.

When the mass of the placenta is expelled, the membranes generally still remain in the vagina, and they should be twisted into a rope, and very gently withdrawn, so as not to leave any portion behind.

The duties of the medical attendant are not even now over. For at least ten minutes after the extrusion of the placenta he should keep his hand on the firmly-contracted uterus, gently kneading it, without any force, for the purpose of promoting firm and equable contraction and causing it to throw off any coagula that may form in its cavity.

Administration of Ergot of Rye.—The subsequent comfort and safety of the patient may be promoted by administering, at this time, a full dose of ergot of rye, such as a drachm, or more, of the liquid extract. The property possessed by this drug of producing tonic and persistent contraction of the uterine fibres, which renders it of doubtful utility as an oxytocic during labor, is of special value after delivery, when such contraction is precisely what we desire. I have long been in the habit of administering the drug at this period, and believe it to be of great value, not only as a prophylactic against hemorrhage, but as a means of lessening after-pains.

Application of the Binder.—When we are satisfied that the permanently contracted, we may apply the binder; but be done until at least half an hour after the birth of the child. The soiled clothes should be gently withdrawn from under the patient, moving her as little as possible, and the binder should be, at the same time, slipped under the body, taking care that it is passed well below the hips, so as to secure a firm hold of the body. No kind of bandage is better than a piece of stout jean, of sufficient breadth to extend from the trochanters to the ensiform cartilage; a jack-towel or bolster-slip answers the purpose very well. These are preferable, at any rate at first, to the shaped binders that are often used. One or two folded napkins are generally placed over the uterus, so as to form a pad to keep up uterine pressure. Once in position, the binder is pulled tight, and fastened by pins. The utility of careful bandaging after delivery can scarcely be doubted, although some years ago it became the fashion to dispense with it. It gives a comfortable support to the lax abdominal walls, keeps up a certain amount of pressure on the uterus, and tends to restore the figure of the patient. After the bandage is applied, a warm napkin should be placed on the vulva, as a means of estimating the quantity of the discharge, and the patient may be allowed to rest.

After-Treatment.—Unless the labor has been very long and fatiguing, an opiate, often exhibited as a matter of routine, is unadvisable; although it may be well to leave one with the nurse, to be given if the patient cannot sleep, or if the after-pains be very troublesome. The practitioner may now leave the room, but not the house, and at least an hour should elapse after delivery before he takes his departure. Before doing so, he should again visit the patient, inspect the napkin to see that there is not too much discharge, and satisfy himself that the uterus is contracted, and not distended with coagula. He should also count the pulse, and, if the patient be progressing satisfactorily, it will be found at its normal average. If, however, it be beating over 100 per minute, he should on no account leave, for such a rapidity of the circulation renders it extremely probable that hemorrhage is impending. This is a good practical rule, laid down by McClintock in his excellent paper "On the Pulse in Child-bed," attention to which may often save the patient from disastrous consequences.

Before leaving, the practitioner should see that the room is darkened, all bystanders excluded, and the patient left as quiet as possible, to recover from the shock of labor.

CHAPTER IV.

ANÆSTHESIA IN LABOR.

A FEW words may be said as to the use of anæsthetics during labor, a practice which has become so universal that no argument is required to establish its being a perfectly legitimate means of assuaging the sufferings of childbirth. Indeed, the tendency in the present day is in the opposite direction; and a common error is the administration of chloroform to an extent which materially interferes with the force of the uterine contractions, and, it can hardly be doubted, predisposes to subsequent post-partum hemorrhage.

Agents Employed.—Practically speaking, the only agent employed in this country is chloroform, although the bi-chloride of methylene, and ether, have been occasionally tried. Of late years, chloral has been extensively used by some; and, as I believe it to be an agent of very great value, I shall first indicate the circumstances under which it may be employed.

The peculiar value of chloral in labor is, that it may be safely administered at a time when chloroform cannot be generally employed. The latter, while it unquestionably annuls suffering, at the same time very frequently tends, in a marked degree, to diminish uterine action. This is a familiar observation to all who have employed it much during labor, as the diminution of the force and intensity of the pains, and the consequent retardation of the labor, often oblige us to suspend its inhalation, at least temporarily. Indeed, this very property of annulling uterine action is one of its most valuable qualities in obstetrics, as in certain cases of turning. For such purposes, indeed, it is necessary to give it to the surgical extent, which we endeavor to avoid when it is used simply to lessen the suffering of ordinary labor. Still, it is not always easy to limit its action in this way, and thus it very frequently does more than we wish. Such diminution in the intensity of uterine contraction is comparatively of less consequence in the propulsive stage, and it is generally more than counterbalanced by the relief it affords. In the first stage it is otherwise, and, practically speaking, chloroform is generally not admissible until the head is in the pelvic cavity.

Chloral, on the other hand, has no such relaxing effects on uterine contraction. It cannot, it is true, compete with chloroform in its power of relieving pain, but it produces a drowsy state, in which the pain is not felt nearly so acutely as before. It is, therefore, in the first stage of labor, while the pains are cutting and grinding, and during the dilatation of the cervix, that it finds its most useful application. I
especially valuable in those cases, so frequently met with in t
classes, in which the pains produce intolerably acute sufferi

little effect on the progress of the labor. In them the os is often thin and rigid, and the pains very frequent and acute, but little or no dilatation is effected. When the patient is brought under the influence of chloral, however, the pains become less frequent, but stronger, nervous excitement is calmed, and the dilatation of the cervix often proceeds rapidly and satisfactorily. Indeed, I know of nothing which answers so well in cases of rigid, undilatable cervix, and I believe its administration to be far more effective, under such circumstances, than any of the remedies usually employed.

Object and Mode of Administration.—The object is to produce a somnolent condition which shall be protracted as long as possible. For this purpose 15 grains of chloral may be administered every twenty minutes, until three doses are given. This generally suffices to produce the desired effect. The patient becomes very drowsy, dozes between the pains, and wakes up as each contraction commences. It may be necessary to give a fourth dose at a longer interval, say an hour after the third dose, to keep up and prolong the soporific action; but this is seldom necessary, and I have rarely given more than a drachm of chloral during the entire progress of labor. Another advantage of this treatment is that, while it does not interfere with the use of chloroform in the second stage, it renders it necessary to give less than otherwise would be called for, and thus its action can be more easily kept within bounds. On the whole, therefore, I am inclined to consider chloral a very valuable aid in the management of labor, and believe that it is destined to be much more extensively used than is at present the case. So far as my experience has yet gone, I have not met with any symptoms which have led me to think that it has produced bad effects; and I have known many patients sleep quietly through labor, without expressing any excessive suffering, or asking for chloroform, who, under ordinary circumstances, would have been most urgently calling for relief.

Generally speaking, we do not think of giving chloroform until the os is fully dilated, the head descending, and the pains becoming propulsive. It has often, indeed, been administered earlier, for the purpose of aiding the dilatation of a rigid cervix, and there is no doubt that it often succeeds well when employed in this way; but I have already stated my belief that chloral answers this purpose better, and that it therefore may advantageously take the place of chloroform for this indication.

There is one cardinal rule to be remembered in giving chloroform during the propulsive stage, and that is, that it should be administered intermittently, and never continuously. When the pain comes on, a few drops may be scattered over a Skinner's inhaler, which affords one of the best means of administering it in labor, or placed within the folds of a handkerchief twisted into the form of a cone. During the acme of the pain the patient inhales it freely, and at once experiences a sense of great relief; and as soon as the pain dies away the inhaler should be removed. In the interval between the pains the effect of the drug passes off, so that the higher degrees of anæsthesia should never be produced. Indeed, when properly given, consciousness should not be entirely abolished, and the patient, between the pains, should be able to speak, and understand what is said to her. This intermittent administration constitutes the peculiar safety of chloroform administered in labor, and it is a fortunate circumstance that as yet there is, I believe, no case on record of death during the inhalation of chloroform for obstetric purposes. This is obviously due to the effect of each inhalation passing off before a fresh dose is administered.

The effect on the pains should be carefully watched. If they become very materially lessened in force and frequency, it may be necessary to stop the inhalation for a short time, commencing again when the pains get stronger, which effect may be often completely and easily prevented by mixing the chloroform with about one-third of absolute alcohol, which, originally recommended, I believe, by Dr. Sansom, increases the stimulating effects of the chloroform, and thus diminishes its tendency to produce undue relaxation. The amount administered must vary, of course, with the peculiarities of each individual case and the effect produced; but it need never be large. As the head distends the perinæum, and the pains get very strong and forcing, it may be given more freely, and it may often be pushed to complete insensibility just before the child is born.

Bearing in mind the tendency of chloroform to produce uterine relaxation, more than ordinary precautions should always be taken against post-partum hemorrhage in all cases in which it has been freely administered.

In cases of operative midwifery it is often given to the extent of complete anæsthesia. In all such cases it should be administered, when possible, by another medical man, and not by the operator, because the giving of chloroform to the surgical degree requires the undivided attention of the administrator, and no man can do this and operate at the same time. I once learnt an important lesson on this point. I had occasion to apply the forceps in the case of a lady who insisted on having chloroform. When commencing the operation, I noticed some suspicious appearances about the patient, who was a large stout woman, with a feeble circulation. I therefore stopped, allowed her to regain consciousness, and delivered her without anæsthesia, much to her own annoyance. Just one month after labor she went to a dentist to have a tooth extracted, and took chloroform, during the inhalation of which she died. This impressed on my mind the lesson that no man can do two things at the same time. The partial unconsciousness of incomplete anæsthesia, in which the patient is restless and tossing about, renders the application of forceps, as well as all other operations, very difficult. Therefore, unless the patient can be completely and fully anæsthetized, it is better to operate without chloroform being given at all.

CHAPTER V.

PELVIC PRESENTATIONS.

UNDER the head of *pelvic* presentations it is customary to include all cases in which any part of the lower extremities of the child presents. By some these are farther subdivided into *breech*, *footling*, and *knee* presentations; but, although it is of consequence to be able to recognize the feet and the knee when they present, so far as the mechanism and management of delivery are concerned, the cases are identical, and, therefore, may be most conveniently considered together.

Frequency.—Presentations coming under this head are far from uncommon; those in which the breech alone occupies the pelvis are met with, according to Churchill, once in 52 labors, while Ramsbotham estimates that it presents more frequently, viz., once in 38.8 labors. Footling presentations occur only once in 92 cases. They are probably often the mere conversion of original breech presentations, the feet having come down during the labor, either in consequence of the sudden escape of the liquor amnii, when the breech was still freely movable above the brim, or from some other cause. Knee presentations are extremely rare, as may be readily understood if it be borne in mind that to admit them the thighs must be extended, hence the vertical measurement of the child must be greatly increased, and therefore it could not be readily accommodated within the uterine cavity, unless of unusually small size. As a matter of fact, Mme. Lachapelle found only one knee presentation in upwards of 3000 cases.

The *causes* of pelvic presentations are not known. They are probably the same as those which produce other varieties of malpresentation; and it is not unlikely that in certain women there may be some peculiarity in the shape of the uterine cavity which favors their production. It would be difficult otherwise to explain such a case as that mentioned by Velpeau, in which the breech presented in six labors.

Prognosis.—The results, as regards the mother, are in no way more unfavorable than in vertex presentation. The first stage of the labor is generally tedious, since the large rounded mass of the breech does not adapt itself so well as the head to the lower segment of the uterus, and dilatation of the cervix is consequently apt to be retarded. The second stage is, however, if anything, more rapid than in vertex cases; and, even when it is protracted, the soft breech does not produce such injurious pressure on the maternal structures as the hard and unyielding head.

The result is very different as regards the child. Dubois calculated that 1 out of 11 children was still-born. Churchill estimates the mortality as much higher, viz., 1 in 3¼. The latter certainly indicates a larger number of still-births than is consistent with the experience of most practitioners, and more than should occur if the cases be properly managed; but there can be no doubt that the risk to the child is, even under the most favorable circumstances, very great.

Causes of Fœtal Mortality.—The chief source of danger is pressure on the umbilical cord in the interval elapsing between the birth of the body and the head. At this time the cord is very generally compressed between the head of the child and the pelvic walls, so that circulation in its vessels is arrested. Hence the aeration of the fœtal blood cannot take place; and, pulmonary respiration not having been yet established, the child dies asphyxiated. There are other conditions present which tend, although in a minor degree, to produce the same result. One of these is that the placenta is probably often separated by the uterine contractions when the bulk of the body is being expelled, as, indeed, takes place, under analogous circumstances, when the vertex presents; the necessary result being the arrest of placental respiration. Joulin thinks that the same effect may be produced by the compression of the placenta between the contracted uterus and the hard mass of the fœtal skull. Probably all these causes combine to arrest the functions of the placenta; and, if the delivery of the head, and consequently the establishment of pulmonary respiration, be delayed, the death of the child is almost inevitable. The corollary is that the danger to the child is in direct proportion to the length of time that elapses between the birth of the body and that of the head.

The risk to the child is greater in footling than in breech cases, because in the former the maternal structures are less perfectly dilated, in consequence of the small size of the feet and thighs, and therefore the birth of the head is more apt to be delayed.

Diagnosis.—Inasmuch as the long axis of the child corresponds with the long axis of the uterus, in pelvic as in vertex presentations, there is nothing in the shape of the uterus to arouse suspicion as to the character of the case. Still, it is often sufficiently easy to recognize a pelvic presentation by abdominal examination, if we have occasion to make one. The facility with which it may be done depends a good deal on the individual patient. If she be not very stout, and if the abdominal parietes be lax and non-resistant, we shall generally be able to feel the round head at the upper part of the uterus, much firmer and more defined in outline than the breech. The conclusion will be fortified if we hear the fœtal heart beating on a level with, or above, the umbilicus. The greater resistance on one side of the abdomen will also enable us to decide, with tolerable accuracy, to which side the back of the child is placed. Information thus acquired is, at the best, uncertain; and we can never be quite sure of the existence of a pelvic presentation until we can corroborate the diagnosis by vaginal examination.

Results of Vaginal Examination.—The first circumstance to excite suspicion on examination *per vaginam*, even when the os is undilated, is the absence of the hard globular mass felt through the lower segment of the uterus, which is so characteristic of vertex presentations. When the os is sufficiently open to allow the membranes to protrude, although the presenting part is too high up to be within reach, we may be struck with the peculiar shape of the bag of membranes, which, instead of being rounded, projects a considerable distance through the os, like the finger of a glove. This is a peculiarity met with in all malpresentations alike, and is, indeed, much less distinct in breech than in footling presentations, because in the former the membranes are more stretched, just as they are in vertex cases. When the membranes rupture, instead of the waters dribbling away by degrees, they often escape with a rush, in consequence of the pelvic extremity not filling up the lower part of the uterus so accurately as the head, which acts as a sort of ball-valve, and prevents the sudden and complete discharge of the waters.

Diagnosis of the Breech.—Often, on first examining, even when the membranes are ruptured, the presentation is too high up to be made out accurately. All that we can be certain of is, that it is not the head; and the case must be carefully watched, and examinations frequently repeated, until the precise nature of the presentation can be established. If the breech present, the finger first impinges on a round, soft prominence, on depressing which a bony protuberance, the trochanter major, can be felt. On passing the finger upwards it reaches a groove, beyond which a similar fleshy mass, the other buttock, can be felt. In this groove various characteristic points, diagnostic of the presentation, can be made out. Towards one end we can feel the movable tip of the coccyx, and above it the hard sacrum, with rough projecting prominences. These points, if accurately made out, are quite characteristic, and resemble nothing in any other presentation. In front there is the anus, in which it is sometimes, but by no means always, possible to insert the tip of the finger. If this can be done it is easy to distinguish it from the mouth, with which it might be confounded, by observing that the hard alveolar ridges are not contained within it. Still more in front we may find the genital organs, the scrotum in male children being often much swollen if the labor has been protracted. Thus it is often possible to recognize the sex of the child before birth.

Differential Diagnosis.—The breech might be mistaken for the face, especially if the latter be much swollen; but this mistake can readily be avoided by feeling the spinous processes of the sacrum.

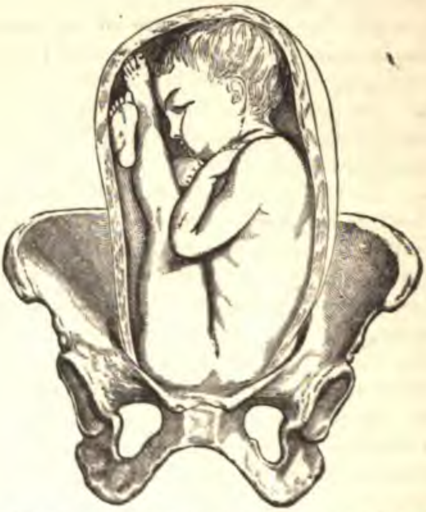
The knee is recognized by its having two tuberosities with a depression between them. It might be confounded with the heel, the elbow, or the shoulder. From the heel, it is distinguished by having two tuberosities instead of one; from the elbow, by the latter having one sharp tuberosity, with a depression on each side, instead of a central depression and two lateral prominences; and from the shoulder, by the latter being more rounded, having only one prominence, running from which the acromion and clavicle can be traced.

Diagnosis of the Foot.—The foot may be mistaken for the hand. This error will be avoided by remembering that all the toes are in the same line, and that the great toe cannot be brought into apposition with the others, as the thumb can with the fingers. The internal border of the foot is much thicker than the external, whereas the two borders of the hand are of the same thickness. Moreover, the foot is articulated at right angles to the leg, and cannot be brought into a line with it, as the hand can with the arm. Finally, the projection of the calcaneum is characteristic, and resembles nothing in the hand.

Mechanism.—As is the case in other presentations, obstetricians have very variously subdivided breech presentations, with the effect of needlessly complicating the subject. The simplest division, and that which will most readily impress itself on the memory of the student, is to describe the breech as presenting in four positions, analogous to those of the vertex, the sacrum being taken as representing the occiput, and the positions being numbered according to the part of the pelvis to which it points. Thus we have—

First, or left sacro-anterior (corresponding to the first position of the vertex). The sacrum of the child points to the left foramen ovale of the mother.

FIG. 100.



FIRST OR LEFT SACRO-COTYLOID POSITION OF THE BREECH.

Second, or right sacro-anterior (corresponding to the second vertex position). The sacrum of the child points to the right foramen ovale of the mother.

Third, or right sacro-posterior (corresponding to the third vertex position). The sacrum of the child points to the right sacro-iliac synchondrosis of the mother.

Fourth, or left sacro-posterior (corresponding to the fourth vertex position). The sacrum of the child points to the left sacro-iliac synchondrosis of the mother.

Of these, as with the corresponding vertex positions, the first and third are the most common, their comparative frequency, no doubt, depending on the same causes. The mechanical conditions to which the presenting part is subjected are also identical, but the alterations of position of the breech in its progress are by no means so uniform as those of the head, on account of its less perfect adaptation to the pelvic cavity. The mechanism of the delivery of the shoulders and head in breech presentations, moreover, is of much greater practical importance than that of the body in vertex presentations, inasmuch as the safety of the child depends on its speedy and satisfactory accomplishment. Bearing these facts in mind, it will suffice to describe briefly the phenomena of delivery in the first and third breech positions.

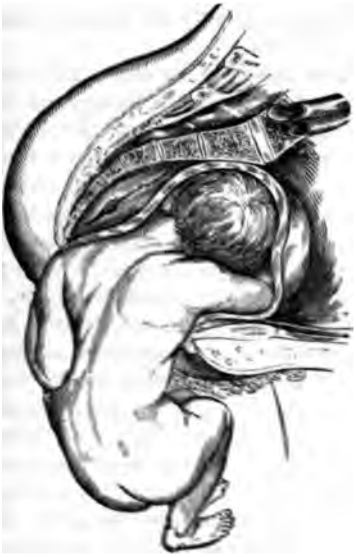
Position of the Child at Brim.—In the first position the sacrum of the child points to the left foramen ovale, and its back is consequently placed to the left side of the uterus and anteriorly, while its abdomen looks to the right side of the uterus and posteriorly. The sulcus between the buttocks lies in the right oblique diameter of the pelvis, while the transverse diameter of the buttocks lies in the left oblique diameter, the left buttock being most easily within reach. As in vertex presentations, the hips of the child lie on the same level at the pelvic brim; although Naegele describes the left hip as placed lower than the right.

Descent.—As the pains act on the body of the child, the breech is gradually forced through the pelvic cavity, retaining the same relations as at the brim, its progress being generally more slow than that of the head, until it reaches the lower pelvic strait, when the same mechanism which produces rotation of the occiput comes to operate upon it. The result is a rotation of the child's pelvis, so that its transverse diameter comes to lie approximately in the antero-posterior diameter of the outlet, its antero-posterior diameter corresponds to the transverse diameter of the mother's pelvis, the left hip lies behind the pubes, and the right towards the sacrum. This rotation, which is admitted by the majority of obstetricians, is altogether denied by Naegele, who believes it to be a merely theoretical assumption. There can be no doubt, however, that it does generally take place, but by no means so constantly as the corresponding rotation of the vertex; and it is not uncommon for it to be entirely absent, and for the hips to be born in the oblique diameter of the outlet. The body of the child is said frequently not to follow the movement imparted to the hips, so that there is more or less of a twist in the vertebral column.

Expulsion of the Hips and Body.—The left hip now becomes firmly fixed behind the pubes, and a movement of extension, analogous to that of the head in vertex presentations, takes place. The right, or posterior, hip revolves round the fixed one, gradually distends the perinæum, and is expelled first, the left hip rapidly following. As soon as both hips are born, the feet slip out, unless they happen to be completely extended upon the child's abdomen. The shoulders soon follow, lying in the left oblique diameter of the pelvis. The left shoulder rotates forwards behind the pubes, where it becomes fixed, the right shoulder sweeping over the perinæum, and being born first. The arms of the child are generally found placed upon its thorax, and are born before the shoulders. Sometimes they are extended over the child's head, thus causing considerable delay, and greatly increasing the risk to the child. It is now generally admitted that such extension is most apt to occur when traction has been made on the child's body with the view of hastening delivery, and that it is rarely met with when the expulsion of the body is left entirely to the natural powers.

Delivery of the Head.—When the shoulders are expelled, the head enters the pelvis in the opposite, or right oblique, diameter, the face looking to the right sacro-iliac synchondrosis. As the greater part of the child is now expelled, and as the head has entered the vagina, the uterus, having a comparatively small mass to contract upon, must obviously act at a great mechanical disadvantage. Still, the pressure of the head on the vagina is a powerful inciter, the accessory muscles of parturition are brought into strong action, and there is usually quite sufficient force to ensure expulsion of the head without artificial aid. On account of the greater resistance to the descent of the occipital end of the head, due to the upward pressure of the spinal column, the pains have the effect of forcing down the anterior portion of the head, and thus ensure the complete flexion of the chin upon the sternum. This is a great advantage from a mechanical point of view, as it causes the short occipito-mental diameter of the head to enter the pelvis in the axis of the uterus and brim. If the head should happen to be in a state of partial extension, as sometimes happens when the pelvis is unusually roomy, the occipito-frontal diameter is placed in a similar relation to the brim, a position certainly less favorable to the easy birth of the head. As the head descends, it experiences a movement of rotation, the occiput passing forwards and to the right, behind the arch of the pubes, the face turning backwards into the hollow of the sacrum. The body of the child will be observed to follow this movement, so that its back is turned towards the mother's abdomen, its anterior surface to the perinæum. The nape of the neck now becomes firmly fixed under the arch of the pubes, the pains act chiefly on the anterior portion of the head, and cause it to sweep over the perinæum, the chin being first born, then the mouth and forehead, and lastly the occiput.

Fig. 101.

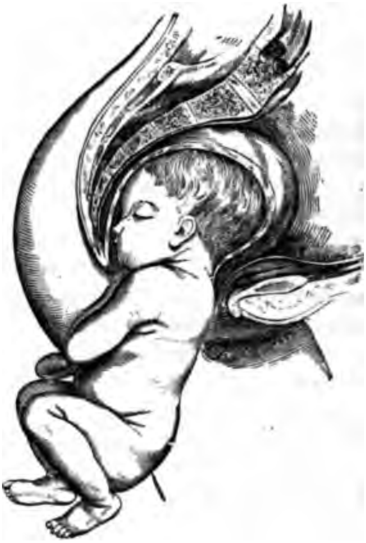


PASSAGE OF THE SHOULDERS, AND PARTIAL ROTATION OF THE THORAX.

Sacro-posterior Positions.—It is needless to describe the differences between the mechanism of the second and first positions, which the student who has mastered the subject of vertex presentations will readily understand. It is necessary, however, to say a few words as to sacro-posterior positions, choosing for that purpose the third, which is the more common of the two. This is exactly the opposite of the first position. The sacrum of the child points to the right sacro-iliac synchondrosis, its abdomen looks forward and to the left side of the mother. The transverse diameter of the child's hips lies in the left oblique diameter, the right hip being anterior. The birth of the body generally takes place exactly in the way that has been already described, the right hip being towards the pubes.

As the head descends into the pelvis, the occiput most usually rotates along its right side—the rotation having been often already partially effected when that of the hips had been made—until it comes to rest behind the pubes, the face passing backwards along the left side of the pelvis into the hollow of the sacrum. This change corresponds exactly to the anterior rotation of the occiput in occipito-posterior positions, and is the natural and favorable termination.

FIG. 102.



DESCENT OF THE HEAD.

Sometimes, however, the rotation does not take place, and the occiput then turns backwards into the hollow of the sacrum. What then generally occurs is that the pains continue, for the reason already mentioned, to depress the chin and produce strong flexion of the face on the sternum, the occiput becoming fixed on the anterior border of the perinæum. The pains continuing to act chiefly on the anterior part of the head, the face is born first behind the pubes, the occiput only slipping over the perinæum after the forehead has been expelled.

A second mode of termination of such positions is mentioned in most works, on the authority of one or two recorded cases; but, although mechanically possible, it is certainly an event of extreme rarity. The chin, instead of being flexed on the sternum, is greatly extended, so that the face of the child looks upwards towards the pelvic brim. The chin then hitches over the upper edge of the pubes and becomes fixed there, while the force of the uterine contractions is expended on the posterior part of the head, which descends through the pelvis, distends the perinæum, and is born first, the face subsequently following.

Mechanism of Feet Presentation.—The mechanism of the delivery of the body and head in cases in which the feet originally present, does not differ in any important respect from that which has been already described, and requires no separate notice.

Treatment.—From what has been said of the natural mechanism of delivery in pelvic presentations, it is evident that one of the most fruitful causes of difficulty and complication is undue interference on the part of the practitioner. It is no doubt tempting to use traction on the partially born trunk in the hope of expediting delivery; but when it is remembered that this is almost certain to produce extension of the arms above the head, and subsequently extension of the occiput on the spine, both of which seriously increase the difficulty of delivery, the necessity of leaving the case as much as possible to nature will be apparent.

Having once, therefore, determined the existence of a pelvic presentation, nothing more should be done until the birth of the breech has been effected. The membranes should be even more carefully prevented from prematurely rupturing than in vertex presentations, since they serve to dilate the genital passages better than the presenting part. Hence they should be preserved intact, if possible, until they reach the floor of the pelvis, instead of being punctured as soon as the os is fully dilated. The breech when born should be received and supported in the palm of the hand.

When the body is expelled as far as the umbilicus, the dangers to the child commence; for now is the time that the cord is apt to be pressed between the body of the child and the pelvic walls. To obviate this risk as much as possible, a loop of the cord should be pulled down, and carried to that part of the pelvis where there is most room, which will generally be opposite one or other sacro-iliac synchondrosis. As long as the cord is freely pulsating, we may be satisfied that the life of the child is not gravely imperilled; although delay is fraught with danger, from other sources which have been already indicated. In most cases the arms now slip out; but it may happen, even without any fault on the part of the accoucheur, that they are extended above the head, and it is of great importance that we should be thoroughly acquainted with the best means of liberating them from their abnormal position.

They must, of course, never be drawn directly downwards, or the almost certain result would be fracture of the fragile bones. We should endeavor to make the arm sweep over the face and chest of the child, so that the natural movements of its joints should not be opposed. If the shoulders be within easy reach, the finger of the accoucheur should be slipped over that which is posterior—because there is likely to be more space for this manœuvre towards the sacrum—and gently carried downwards towards the elbow, which is drawn over the face, and then onwards, so as to liberate the forearm. The same manœuvre should then be applied to the opposite arm. It may be that the shoulders are not easily reached, and then they may be depressed by altering the position of the child's body. If this be carried well up to the mother's abdomen, the posterior shoulder will be brought lower down; and by reversing this procedure and carrying the body back over the perinæum the anterior shoulder may be similarly depressed. It is only very exceptionally, however, that these expedients are required.

Birth of the Head.—The arms being extracted, some degree of artificial assistance is, at this time, almost always required. If there be much delay, the child will almost certainly perish. Attempts have been made, in cases in which delivery of the head could not be rapidly effected, to establish pulmonary respiration by passing one or two fingers into the vagina, so as to press it back and admit the access of air to the child's mouth, or by passing a catheter or tube into the mouth. Neither of these expedients, however, is reliable, and we should rather seek to aid nature in completing the birth of the head as rapidly as possible. The first thing to do, supposing the face to have rotated into the cavity of the sacrum, is to carry the body of the child well up towards the pubes and abdomen of the mother without applying any traction, for fear of interfering with the all-important flexion of the chin on the sternum. If now the patient bear down strongly, the natural powers may be sufficient to complete delivery. If there be any delay, traction must be resorted to, and we must endeavor to apply it in such a way as to ensure flexion. For this purpose, while the body of the child is grasped by the left hand, and drawn upwards towards the mother's abdomen, the index and middle fingers of the right hand are placed on the back of the child's neck, so that their tips press on either side of the base of the occiput, and push the head into a state of flexion. In most works we are advised to pass the index and middle fingers of the left hand at the same time over the child's face, so as to depress the superior maxilla. Dr. Barnes insists that this is quite unnecessary, and that extraction in the manner indicated, by pressure on the occiput, is quite sufficient. Should it not prove so, flexion of the chin may be very affectually assisted by downward pressure on the forehead through the rectum. One or two fingers of the left hand can readily be inserted into the bowel, and the expulsion of the head is thus materially facilitated.

Pressure through the Abdomen.—By far the most powerful aid, however, in hastening delivery of the head, should delay occur, is pressure from above. This has been, strangely enough, almost altogether omitted by writers on the subject. It has been strongly recommended by Professor Penrose; and there can be no question of its utility. Indeed, as the uterus contracts tightly round the head, uterine expression can be applied almost directly to the head itself, and without any fear of deranging its proper relation to the maternal passages. It is very seldom indeed that a judicious combination of traction on the part of the accoucheur, with firm pressure through the abdomen applied by an assistant, will fail in effecting delivery of the head before the delay has had time to prove injurious to the child.

Application of the Forceps.—Many accoucheurs—among others Busch, Meigs, and Rigby—advocate the application of the forceps when there is delay in the birth of the after-coming head. If the delay be due to want of expulsive force in a pelvis of normal size, manual extraction, in the manner just described, will be found to be sufficient in almost every case, and preferable, as being more rapid, easier of execution, and safer to the child. The forceps may be quite properly tried, if other means have failed; especially if there be some disproportion between the size of the head and the pelvis.

Difficulties in delivery may also occur in sacro-posterior positions. Up to the time of the birth of the head the labor usually progresses as readily as in sacro-anterior positions. If the forward rotation of the hips do not take place, much subsequent difficulty may be prevented by gently favoring it by traction applied to the breech during the pains, the finger being passed for this purpose into the fold of the groin.

It is after the birth of the shoulders that the absence of rotation is most likely to prove troublesome. It has been recommended by some that the body should then be grasped, in the interval between the pains, and twisted round so as to bring the occiput forward. It is by no means certain, however, that the head would follow the movement imparted to the body, and there must be a serious danger of giving a fatal twist to the neck by such a manœuvre. The better plan is to attempt to direct the face backwards, towards the cavity of the sacrum, by pressing on the anterior temple during the continuance of a pain. In this way the proper rotation will generally be effected without much difficulty, and the case will terminate in the usual way.

If rotation of the occiput forwards do not occur, it is necessary for the practitioner to bear in mind the natural mechanism of delivery under such circumstances. In the majority of cases the proper plan is to favor flexion of the chin by upward pressure on the occiput, and to exert traction directly backwards, remembering that the nape of the neck should be fixed against the anterior margin of the perinæum. If this be not remembered, and traction be made in the axis of the pelvic outlet, the delivery of the head might be seriously impeded. In the rare cases in which the head becomes extended, and the chin protrudes over the upper margin of the pubes, traction directly forwards and upwards may be required to deliver the head; but before resorting to it care should be taken to ascertain that backward extension of the head has really taken place.

Impacted Breech Presentations.—It remains for us to consider the measures which may be adopted in those very troublesome cases in which the breech refuses to descend, and becomes impacted in the pelvic cavity, either from uterine inertia, or from disproportion between the breech and the pelvis. Here, unfortunately, the peculiar shape of the presenting part, which is unadapted for the application of the forceps, renders such cases very difficult to manage.

Two measures have been chiefly employed: 1st, bringing down one or both feet, so as to break up the presenting part and convert it into a footling case; 2d, traction on the breech, either by the fingers, a blunt hook, or fillet passed over the groin.

Barnes insists on the superiority of the former plan, and there can be no question that, if a foot can be got down, the accoucheur has a complete control over the progress of the labor, which he can gain in no other way. If the breech be arrested at or near the brim, there will generally be no great difficulty in effecting the desired object. It will be necessary to give chloroform to the extent of complete anæsthesia, and to pass the hand over the child's abdomen in the same manner and with the same precautions as in performing podalic version, until a foot is reached, which is seized and pulled down. If the feet be placed in the usual way close to the buttocks, no great difficulty is likely to be experienced. If, however, the legs be extended on the abdomen, it will be necessary to introduce the hand and arm very deeply, even up to the fundus of the uterus, a procedure which is always difficult, and which may be very hazardous. Nor do I think that the attempt to bring down the feet can be safe when the breech is low down and fixed in the pelvic cavity. A certain amount of repression of the breech is certainly possible, but it is evident that this cannot be safely attempted when the breech is at all low down.

Traction on the Groin.—Under such circumstances traction is our only resource; and this is always difficult, and often unsatisfactory. Of all contrivances for this purpose none is better than the hand of the accoucheur. The index finger can generally be slipped over the groin without difficulty, and traction can be applied during the pains. Failing this, or when it proves insufficient, an attempt should be made to pass a fillet over the groins. A soft silk handkerchief, or a skein of worsted, answers best, but it is by no means easy to apply. The simplest plan, and one which is far better than the expensive instruments contrived for the purpose, is to take a stout piece of copper wire and bend it double into the form of a hook. The extremity of this can generally be guided over the hips, and through its looped end the fillet is passed. The wire is now withdrawn, and carries the fillet over the groins. I have found this simple contrivance, which can be manufactured in a few moments, very useful, and by means of such a fillet very considerable tractive force can be employed. The use of a soft fillet is in every way preferable to the blunt hook which is contained in most obstetric bags. A hard instrument of this kind is quite as difficult to apply, and any strong traction employed by it is almost certain to seriously injure the delicate fœtal structures over which it is placed. As an auxiliary the employment of uterine expression should not be forgotten, since it may give material aid when the difficulty is only due to uterine inertia.

Embryotomy.—Failing all endeavors to deliver by these expedients, there is no resource left but to break up the presenting part by scissors, or by craniotomy instruments; but, fortunately, so extreme a measure is but rarely necessary.

CHAPTER VI.

PRESENTATIONS OF THE FACE.

PRESENTATIONS of the face are by no means rare; and, although in the great majority of cases they terminate satisfactorily by the unassisted powers of nature, yet every now and then they give rise to much difficulty, and then they may be justly said to be amongst the most formidable of obstetric complications. It is, therefore, essential that the practitioner should thoroughly understand the natural history of this variety of presentation, with the view of enabling him to intervene with the best prospect of success.

The older accoucheurs held very erroneous views as to the mechanism and treatment of these cases, most of them believing that delivery was impossible by the natural efforts, and that it was essential to intervene by version in order to effect delivery. Smellie recognized the fact that spontaneous delivery is possible, and that the chin turns forwards and under the pubes; but it was not until long after his time, and chiefly after the appearance of Mme. Lachapelle's essay on the subject, that the fact that most cases could be naturally delivered was fully admitted and acted upon.

The *frequency* of face presentations varies curiously in different countries. Thus, Collins found that in the Rotunda Hospital there was only 1 case in 497 labors, although Churchill gives 1 in 249 as the average frequency in British practice; while in Germany it is met with once in 169 cases. The only reasonable explanation of this remarkable difference is, that the dorsal decubitus, generally followed abroad, favors the transformation of vertex presentations into those of the face.

The mode in which this change is effected—for it can hardly be doubted that, in the large majority of cases, face presentation is due to a backward displacement of the occiput after labor has actually commenced, but before the head has engaged in the brim—has been made the subject of various explanations.

It has generally been supposed that the change is produced by a hitching of the occiput on the brim of the pelvis, so as to produce extension of the head, and descent of the face; the occurrence being favored by the oblique position of the uterus so frequently met with in pregnancy. According to Hecker, this occurrence is greatly favored by a peculiarity in the shape of the fœtal head generally observed in face presentations, the cranium having the dolicho-cephalous form, prominent posteriorly, with the occiput projecting, which has the effect of increasing the length of the posterior cranial lever arm, and facilitating extension when circumstances favoring it are in action. Dr. Duncan[1] attaches great importance to uterine obliquity, but in a different way to that above referred to. He points out that, when obliquity is very marked, a curve in the genital passages is produced, the convexity of which is directed to the side towards which the uterus is deflected. When uterine contraction commences, the fœtus is propelled downwards, and the part corresponding to the concavity of the curve is acted on to the greatest advantage by the propelling force, and tends to descend. Should the occiput happen to lie in the convexity of the curve so formed, the tendency will be for the forehead to descend. In the majority of cases its descent will be prevented by the increased resistance it meets with in consequence of the greater length of the anterior cranial lever arm; but if the uterine obliquity be extreme, this may be counterbalanced, and a face presentation ensues. The influence of this obliquity is corroborated by the observation of Baudelocque, that the occiput in face presentations almost invariably corresponds to the side of the uterine obliquity. A farther corroboration is afforded by the fact that in face presentation the occiput is much more frequently directed to the right than to the left; while right lateral obliquity of the uterus is also much more common.

These theories assume that face presentations are produced during labor. In a few cases they certainly exist before labor has commenced. It is possible, however, as we know that uterine contractions exist independently of actual labor, that similar causes may also be in operation, although less distinctly, before the commencement of labor.

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[1] Edin. Med. Journ., vol. xv.

The *diagnosis* is often a matter of considerable difficulty at an early period of labor, before the os is fully dilated and the membranes ruptured, and when the face has not entered the pelvic cavity. The finger then impinges on the rounded mass of the forehead, which may very readily be mistaken for the vertex. When labor is advanced, and the head has somewhat descended, or when the membranes are ruptured, we should be able to make out the nature of the presentation with certainty. The diagnostic marks to be relied on are the edges of the orbits, the prominence of the nose, the nostrils (their orifices showing to which part of the pelvis the chin is turned), and the cavity of the mouth, with the alveolar ridges. If these be made out satisfactorily, no mistake should occur. The most difficult cases are those in which the face has been a considerable time in the pelvis. Under such circumstances the cheeks become greatly swollen and pressed together, so as to resemble the nates. The nose might then be mistaken for the genital organs, and the mouth for the anus. The orbits, however, and the alveolar ridges within the mouth, resemble nothing in the breech, and should be sufficient to prevent error. Considerable care should be taken not to examine too frequently and roughly, otherwise serious injury to the delicate structures of the face might be inflicted. When once the presentation has been satisfactorily diagnosed, examinations should be made as seldom as possible, and only to assure ourselves that the case is progressing satisfactorily.

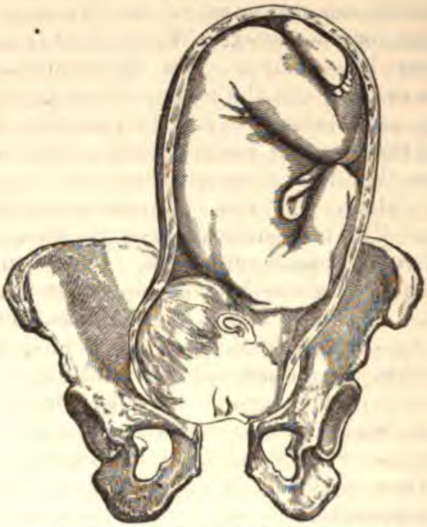
Mechanism.—If we regard face presentations, as we are fully justified in doing, as being generally produced by the extension of the occiput in what were originally vertex presentations, we can readily understand that the position of the face in relation to the pelvis must correspond to that of the vertex. This is, in fact, what is found to be the case, the forehead occupying the position in which the occiput would have been placed had extension not occurred.

The face, then, like the head, may be placed with its long diameter corresponding to almost any of the diameters of the brim, but most generally it lies either in the transverse diameter, or between this and the oblique, while as it descends in the pelvis it more generally occupies one or other of the oblique diameters. It is common in obstetric works to describe two principal varieties of face presentation, the right and left mento-iliac, according as the chin is turned to one or other side of the pelvis. It is better, however, to classify the positions in accordance with the part of the pelvis to which the chin points. We may, therefore, describe four positions of the face, each being analogous to one of the ordinary vertex presentations, of which it is the transformation.

First Position.—The chin points to the right sacro-iliac synchondrosis, the forehead to the left foramen ovale, the long diameter of the face lies in the right oblique diameter of the pelvis. This corresponds to the first position of the vertex, and, as in that, the back of the child lies to the left side of the mother.

Second Position.—The chin points to the left sacro-iliac synchondrosis, the forehead to the right foramen ovale, and the long diameter of the face lies in the left oblique diameter of the pelvis. This is the conversion of the second vertex position.

FIG. 103.



SECOND POSITION IN FACE PRESENTATIONS.

Third Position.—The forehead points to the right sacro-iliac synchondrosis, the chin to the left foramen ovale, and the long diameter of the face lies in the right oblique diameter of the pelvis. This is the conversion of the third vertex position.

Fourth Position.—The forehead points to the left sacro-iliac synchondrosis, the chin to the right foramen ovale, and the long diameter of the face lies in the left oblique diameter of the pelvis. This is the conversion of the fourth vertex position.

The *relative frequency* of these presentations is not yet positively ascertained. It is certain that there is not the preponderance of first facial that there is of first vertex positions, and this may, no doubt, be explained by the supposition that an unusual vertex position may of itself facilitate the transformation into a face presentation. Winckel concludes that, *cœteris paribus*, a face presentation is more readily produced when the back of the child lies to the right than when it lies to the left side of the mother; the reason for this being probably the frequency of right lateral obliquity of the uterus. We shall presently see that, with very rare exceptions, it is absolutely essential that the chin should rotate forwards under the pubes before delivery can be accomplished; and, therefore, we may regard the third and fourth face positions, in which the chin from the first points anteriorly, as more favorable than the first and second.

The mechanism of delivery in face is practically the same
presentations; and we shall have no difficulty in unders

bear in mind that in face cases the chin takes the place of, and represents, the occiput in vertex presentations. For the purpose of description we may take the first position of the face.

1. The first step consists in the *extension* of the head, which is effected by the uterine contractions as soon as the membranes are ruptured. By this the occiput is still more completely pressed back on the nape of the neck, and the fronto-mental, rather than the mento-bregmatic, diameter is placed in relation to the pelvic brim. This corresponds to the stage of flexion in vertex presentations.

The chin and front parts of the face descend below the forehead, from precisely the same reason as the occiput descends in vertex presentations. On account of the extended position of the head, the presenting face is divided into portions of unequal length in relation to the vertebral column, through which the force is applied, the longer lever arm being towards the forehead. The resistance is, therefore, greatest towards the forehead, which remains behind while the chin descends.

2. *Descent.*—As the pains continue, the head (the chin being still in advance) is propelled through the pelvis. It is generally said that the face cannot descend, like the occiput, down to the floor of the pelvis, its descent being limited to the length of the neck. There is here, however, an obvious misapprehension. The neck from the chin to the sternum, when the head is forcibly extended, measures from three and a half to four inches, a length that is more than sufficient to admit of the face descending to the lower pelvic strait. As a matter of fact, the chin is frequently observed in mento-posterior positions to descend so far that it is apparently endeavoring to pass the perinæum before rotation occurs. At the brim the two sides of the face are on a level, but, as labor advances, the right cheek descends somewhat, the caput succedaneum forms on the malar bone, and, if a secondary caput succedaneum form, on the cheek.

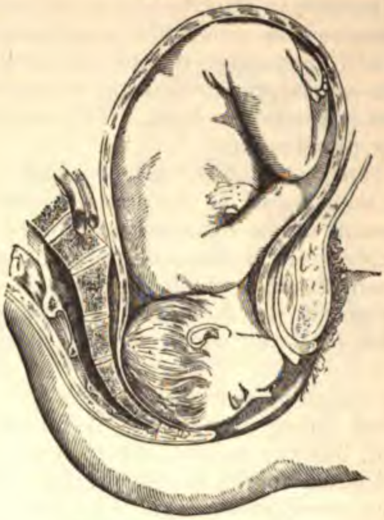
3. *Rotation* is by far the most important point in the mechanism of face presentations; for, unless it occur, delivery, with a full-sized head and an average pelvis, is practically impossible. There are, no doubt, exceptions to this rule, which must be separately considered; but it is certain that the absence of rotation is always a grave and formidable complication of face presentation. Fortunately, it is only very rarely that it is not effected. The mechanical causes are precisely those which produce rotation of the occiput forwards in vertex presentations. As it is accomplished, the chin passes under the arch of the pubes, and the occiput rotates into the hollow of the sacrum (Fig. 104); and then commences—

4. *Flexion,* a movement which corresponds to extension in vertex cases. The chin passes as far under the pubes as the arch will allow, and there becomes fixed. The uterine force is now expended on the occiput, which rotates, as it were, on its transverse axis (Fig. 105), the under surface of the chin resting on the pubes as a fixed point. This movement goes on until, at last, the face and occiput sweep over the distended perinæum.

5. *External Rotation* is precisely similar to that which takes place in

head presentations, and, like it, depends on the movements imparted to the shoulders.

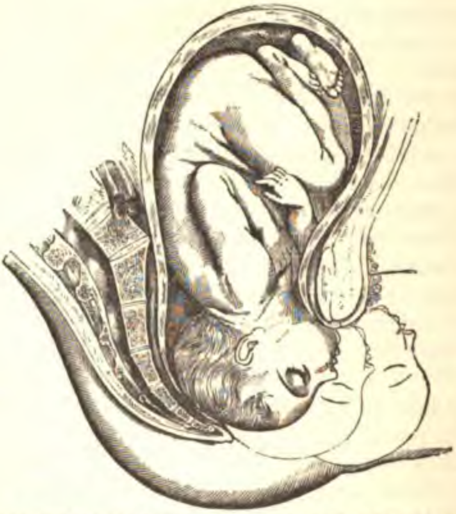
FIG. 104.



ROTATION FORWARDS OF CHIN.

Such is the natural course of delivery in the vast majority of cases; but, in order fully to understand the subject, it is necessary to study

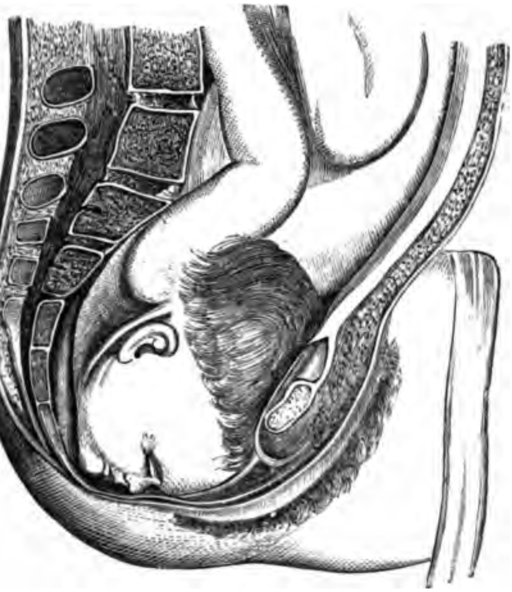
FIG. 105.



PASSAGE OF THE HEAD THROUGH THE EXTERNAL PARTS IN FACE PRESENTATION.

those rare cases in which the chin points backwards and anter tion does not occur. These may be taken to correspond posterior positions, in which the face is born looking to the pubes; but, unlike them, it is only very exceptionally that nature is able to complete the delivery. The reason of this is obvious, for the occiput gets jammed behind the pubes, and there is no space for the fronto-mental diameter to pass the antero-posterior diameter of the outlet (Fig. 106).

FIG. 106.



ILLUSTRATING THE POSITION OF THE HEAD WHEN FORWARD ROTATION OF THE CHIN DOES NOT TAKE PLACE.

Cases are indeed recorded in which delivery has been effected with the chin looking posteriorly; but there is every reason to believe that this can only happen when the head is either unusually small or the pelvis unusually large. In such cases the forehead is pressed down until a portion appears at the ostium vaginæ, when it becomes firmly fixed behind the pubes, and the chin, after many efforts, slips over the perinæum. When this is effected, flexion occurs, and the occiput is expelled without difficulty. The forehead is probably always on a lower level than the chin.

Dr. Hicks[1] has published a paper in which he attempts to show that this termination of face presentations is not so rare as is generally supposed, and he gives a single instance in which he effected delivery with the forceps; but he practically admits that special conditions are necessary, such as "the antero-posterior diameter of the outlet particularly ample," and a diminished size of the head. When delivery is effected, it is probable, as Cazeaux has pointed out, that the face lies in the oblique diameter of the outlet, and that the chin depresses the soft structures at the side of the sacro-ischiatic notch, which yield to the extent of a quarter of an inch or more, and thereby permit the passage of the occipito-mental diameter of the head. It must, however, be borne well in mind that spontaneous delivery in mento-posterior positions is the rare exception, and that, supposing rotation does not occur—and it often does so at the last moment—artificial aid in one form or another will be almost certainly required.

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[1] Obst. Trans., vol. vii.

Prognosis of Face Presentations.—As regards the mother, in the great majority of cases the prognosis is favorable, although the labor is apt to be prolonged, and she is, therefore, more exposed to the risks attending tedious delivery. As regards the child, the prognosis is much more unfavorable than in vertex presentations. Even when the anterior rotation of the chin takes place in the natural way, it is estimated that 1 out of 10 children is still-born; while if not, the death of the child may almost certainly be expected. This increased infantile mortality is evidently due to the serious amount of pressure to which the child is subjected, and probably depends in many cases on cerebral congestion, produced by pressure on the jugular veins as the neck lies in the pelvic cavity. Even when the child is born alive the face is almost always greatly swollen and disfigured. In some cases the deformity produced in this way is excessive, and the features are often scarcely recognizable. This disfiguration passes away in a few days; but the practitioner should be aware of the probability of its occurrence, and should warn the friends, or they might be unnecessarily alarmed, and possibly might lay the blame on his shoulders.

Treatment.—After what has been said as to the mechanism of delivery in face presentation, it is obvious that the proper course is to leave the case alone, in the expectation of the natural efforts being sufficient to complete delivery. Fortunately, in the large majority of cases this course is attended by a successful result.

The older accoucheurs, as has been stated, thought active interference absolutely essential, and recommended either podalic version, or the attempt to convert the case into a vertex presentation, by inserting the hand and bringing down the occiput. The latter plan was recommended by Baudelocque, and is even yet followed by some accoucheurs. Thus, Dr. Hodge[1] advises it in all cases in which face presentation is detected at the brim; and although it might not have been attended with evil consequences in his experienced hands, it is certainly altogether unnecessary, and would infallibly lead to most serious results if generally adopted. It might, however, be allowable in certain cases in which the face remains above the brim and refuses to descend into the pelvic cavity. Even then it is very questionable whether podalic version should not be preferred, as being easier of performance, giving, when once effected, a much more complete control over delivery, and being less painful to the mother. Version is certainly preferable to the application of the forceps, which are introduced with difficulty in so high a position of the face, and do not take a secure hold.

When once the face has descended into the pelvis, difficulties may arise from two chief causes: uterine inertia, or non-rotation for of the chin.

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[1] System of Obstetrics, p. 335.

The treatment of the former class must be based on precisely the same general principles as in dealing with protracted labor in vertex presentations. The forceps may be applied with advantage, bearing in mind the necessity of getting the chin under the pubes, and, when this has been effected, of directing the traction forwards, so as to make the occiput slowly and gradually distend and sweep over the perinæum.

The second class of difficult face cases are much more important, and may try the resources of the accoucheur to the utmost. Our first endeavor must be, if possible, to secure the anterior rotation of the chin. For this purpose various manœuvres are recommended. By some, we are advised to introduce the finger cautiously into the mouth of the child, and draw the chin forwards during a pain; by others, to pass the finger up behind the occiput and press it backwards during the pain. Schroeder points out that the difficulty often depends on the fact of the head not being sufficiently extended, so that the chin is not on a lower level than the forehead; and that rotation is best promoted by pressing the forehead upwards with the finger during a pain, so as to cause the chin to descend. Any, or all, of these plans may be tried. We must bear in mind, in using them, that rotation is often delayed until the face is quite at the lower pelvic strait, so that we need not too soon despair of its occurring. If, however, in spite of these manœuvres, it do not take place, what is to be done? If the head be not too low down in the pelvis to admit of version, that, no doubt, would be the simplest and most effectual plan. I have succeeded in delivering in this way, when all attempts at producing rotation had failed; but generally the face will be too decidedly engaged to render it possible. An attempt might be made to bring down the occiput by the vectis, or by a fillet; but if the face be in the pelvic cavity it is hardly possible for this plan to succeed. An endeavor may be made to produce rotation by the forceps; but it should be remembered that rotation of the face mechanically in this way is very difficult, and much more likely to be attended with fatal consequences to the child than when it is effected by the natural efforts. In using forceps for this purpose, the second or pelvic curve is likely to prove injurious, and a short straight instrument is to be preferred. If rotation be found to be impossible, an endeavor may be made to draw the face downwards, so as to get the chin over the perinæum and deliver in the mento-posterior position; but, unless the child be small, or the pelvis very capacious, the attempt is unlikely to succeed. Finally, if all these means fail, there is no resource left but lessening the size of the head by craniotomy, a *dernier ressort* which, fortunately, is very rarely required.

Brow Presentations.—It sometimes happens that the head is partially extended, so as to bring the os frontis into the brim of the pelvis and form what is described as a "*brow presentation.*" Should the head descend in this manner, the difficulties, although not insuperable, are apt to be very great, from the fact that the long cervico-frontal diameter of the head is engaged in the pelvic cavity. The diagnosis is not difficult, for the os frontis will be detected by its rounded surface; while the anterior fontanelle is within reach in one direction, the orbit, and root of the nose, in another.

Fortunately, in the large majority of cases brow presentations are spontaneously converted into either vertex or face presentations, according as flexion or extension of the head occurs; and these must be regarded as the desirable terminations and the ones to be favored. For this purpose upward pressure must be made on one or other extremity of the presenting part during a pain, so as to favor flexion, or extension; or, if the parts be sufficiently dilated, an attempt may be made to pass the hand over the occiput and draw it down, thus performing cephalic version. The latter is the plan recommended by Hodge, who describes the operation as easy. It is questionable, however, if a well-marked brow presentation be distinctly made out while the head is still at the brim, whether podalic version would not be the easiest and best operation. If the forehead have descended too low for this, and if the endeavor to convert it either into a face or vertex presentation fail, the forceps will probably be required. In such cases the face generally turns towards the pubes, the superior maxilla becomes fixed behind the pubic arch, and the occiput sweeps over the perinæum. Very great difficulty is likely to be experienced, and, if conversion either into a vertex or face presentation cannot be effected, craniotomy is not unlikely to be required.

CHAPTER VII.

DIFFICULT OCCIPITO-POSTERIOR POSITIONS.

A FEW words may be said in this place as to the management of occipito-posterior positions of the head, especially of those cases in which forward rotation of the occiput does not take place. It has already been pointed out that in the large majority of these cases the occiput rotates forwards without any particular difficulty, and the case terminates in the usual way, with the occiput emerging under the arch of the pubes.

In a certain number of cases, however, such rotation does not occur, and difficulty and delay are apt to follow. The proportion of cases in which face to pubes terminations of occipito-posterior positions occur has been variously estimated, and they are certainly more common than most of our text-books lead us to expect. Dr. Uvedale West,[1] who has studied the subject with great care, found that labor ended in this way in 79 out of 2585 births, all these deliveries being exceptionally difficult.

Causes of Face to Pubes Delivery.—He believed that forward rotation of the head is prevented by the absence of flexion of the chin on the sternum, so that the long occipito-frontal, instead of the occipito-bregmatic, diameter of the head is brought into contact with the pelvic diameter; hence the occiput is no longer the lowest point, and is not subjected to the action of those causes which produce forward rotation. Dr. Macdonald, who has written a thoughtful paper on the subject,[1] believes that the non-rotation forwards of the occiput is chiefly due to large size of the head, in consequence of which "the forehead gets so wedged into the pelvis anteriorly that its tendency to slacken and rotate forwards does not come into play." Dr. West's explanation, which has an important bearing on the management of these cases, seems most correctly to explain the non-occurrence of the natural rotation.

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[1] Cranial Presentations, p. 33.

The important question for us to decide is, how can we best assist in the management of cases of this kind when difficulties arise and labor is seriously retarded?

Dr. West, insisting strongly on the necessity of complete flexion of the chin on the sternum, advises that this should be favored by upward pressure on the frontal bone, with the view of causing the chin to approach the sternum, and the occiput to descend, and thus to come within the action of the agencies which favor rotation. Supposing the pains to be strong, and the fontanelle to be readily within reach, we may, in this way, very possibly favor the descent of the occiput, and without injuring the mother or increasing the difficulties of the case in the event of the manœuvre failing. The rotation of the face backwards may at the same time be favored by pressure on the pubic side of the forehead during the pains.

Others have advised that the descent of the occiput should be promoted by downward traction, applied by the vectis or fillet. The latter is the plan specially advocated by Hodge;[2] and the fillet certainly finds one of its most useful applications in cases of this kind, as being simpler of application, and probably more effective, than the vectis.

Although any of these methods may be adopted, a word of caution is necessary against prolonged and over-active endeavors at producing flexion and rotation when that seems delayed. All who have watched such cases must have observed that rotation often occurs spontaneously at a very advanced period of labor, long after the head has been pressed down for a considerable time to the very outlet of the pelvis, and when it seems to have been making fruitless endeavors to emerge; so that a little patience will often be sufficient to overcome the difficulty.

In the event of assistance being absolutely required, there is no reason why the forceps should not be used. The instrument is not more difficult to apply than under ordinary circumstances, nor, as a rule, is much more traction necessary. Dr. Macdonald, indeed, in the paper already alluded to, maintains that in persistent occipito-posterior positions there is almost always a want of proportion between the head and the pelvis, and that, therefore, the forceps will be generally required, and he prefers them to any artificial attempts at rectification. Some peculiarities in the mode of delivery are necessary to bear in mind. In most works it is taught that the operator should pay special attention to the rotation of the head, and should endeavor to impart this movement by turning the occiput forwards during extraction. Thus, Tyler Smith says, "In delivery with the forceps in occipito-posterior positions, the head should be slowly rotated during the process of extraction, so as to bring the vertex towards the pubic arch, and thus convert them into occipito-posterior presentations." The danger accompanying any forcible attempt at artificial rotation will, however, be evident on slight consideration. It is true that in many cases, when simple traction i applied, the occiput will of itself rotate forwards, carrying the instrument with it. But that is a very different thing from forcibly twistin round the head with the blades of the forceps, without any assuran that the body of the child will follow the movement. It is impossil to conceive that such violent interference should not be attended wi serious risk of injury to the neck of the child. If rotation do not occ the fair inference is that the head is so placed as to render deliv with the face to the pubes the best termination, and no endea should be made to prevent it. This rule of leaving the rotation enti to nature, and using traction only, has received the approval of Ba and most modern authorities, and is the one which commends itsel the most scientific and reasonable.

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[1] Edin. Med. Journ., Oct. 1874.

[2] System of Obstetrics, p. 308.

These are cases in which the pelvic curve of the forceps is of d ful utility. When applied in the usual way the convexity of the b of course points backwards. If rotation accompany extractio blades necessarily follow the movement of the head, and their c edges will turn forwards. It certainly seems probable that such a ment would subject the maternal soft parts to considerable risk. I however, more than once seen such rotation of the instrument without any apparent bad result; but the dangers are obvious. it would be a wise precaution either to use a pair of straight for this particular operation, or to remove the blades and leave to be terminated by the natural powers, when the head is at th strait and rotation seems about to occur. When there is no more than usual care should be taken with the perinæum, necessarily much stretched by the rounded occiput. Indeed, tl the perinæum is very considerable, and, even with the greate may be impossible to avoid laceration.

Bearing these precautions in mind, delivery with the f occipito-posterior positions offers no special difficulties or dan

CHAPTER VIII.

PRESENTATIONS OF SHOULDER, ARM, OR TRUNK—COMPLEX PRESENTATIONS—PROLAPSE OF THE FUNIS.

In the presentations already considered, the long diameter of the fœtus corresponded with that of the uterine cavity, and in all of them the birth of the child by the maternal efforts was the general and normal termination of labor. We have now to discuss those important cases in which the long diameter of the fœtus and uterus do not correspond, but in which the long fœtal diameter lies obliquely across the uterine cavity. In the large majority of these it is either the shoulder, or some part of the upper extremity, that presents; for it is an admitted fact that although other parts of the body, such as the back, or abdomen, may, in exceptional cases, lie over the os at an early period of labor, yet, as labor progresses, such presentations are almost always converted into those of the upper extremity.

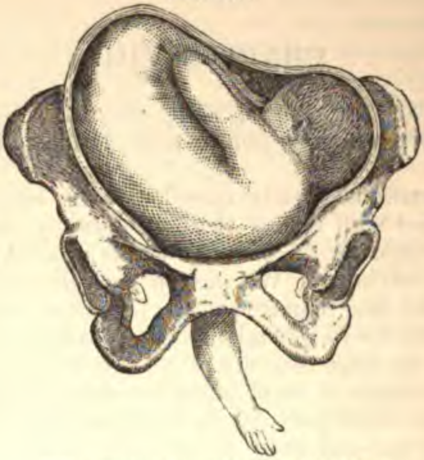
For all practical purposes we may confine ourselves to a consideration of *shoulder* presentations; the further subdivision of these into *elbow* or *hand* presentations being no more necessary than the division of pelvic presentations into breech, knee, and footling cases, since the mechanism and management are identical, whatever part of the upper extremity presents.

There is this great distinction between the presentations we are now considering and those already treated of, that, on account of the relations of the fœtus to the pelvis, delivery by the natural powers is impossible, except under special and very unusual circumstances that can never be relied upon. Intervention on the part of the accoucheur is, therefore, absolutely essential, and the safety of both the mother and child depends upon the early detection of the abnormal position of the fœtus; for the necessary treatment, which is comparatively easy and safe before labor has been long in progress, becomes most difficult and hazardous if there have been much delay.

Presentations of the upper extremity or trunk are often spoken of as "*transverse presentations*" or "*cross-births;*" but both of these terms are misleading, as they imply that the fœtus is placed transversely in the uterine cavity, or that it lies directly across the pelvic brim. As matter of fact, this is never the case, for the child lies obliquely in the uterus, not indeed in its long axis, but in one intermediate between its long and transverse diameters.

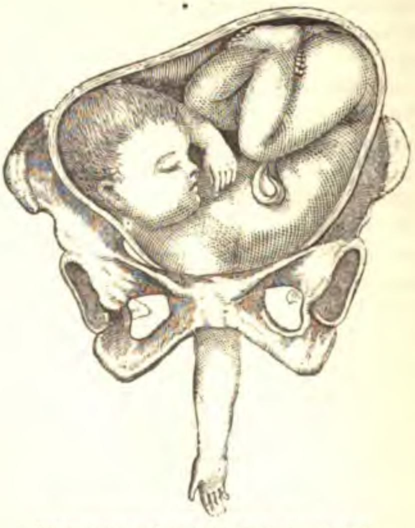
Two great divisions of shoulder presentations are recognized; those in which the back of the child looks to the abdomen of the mother (Fig. 107), and those in which the back of the child is turned towards the spine of the mother (Fig. 108). Each of these is subdivided into two subsidiary classes, according as the head of the child is placed in the right or left iliac fossa. Thus, in dorso-anterior positions, if the head lie in the left iliac fossa, the right shoulder of the child presents; if in the right iliac fossa, the left. So in dorso-posterior positions, if the head lie in the left iliac fossa, the left shoulder presents; if in the right, the right. Of the two classes the dorso-anterior positions are more common, in the proportion, it is said, of two to one.

FIG. 107.



DORSO-ANTERIOR PRESENTATION OF THE ARM.

FIG. 108.



DORSO-POSTERIOR PRESENTATION OF THE ARM.

The *causes* of shoulder presentation are not well known. Amongst those most commonly mentioned are prematurity of the fœtus, and excess of liquor amnii; either of these, by increasing the mobility of the fœtus in utero, would probably have considerable influence. The fact that it occurs much more frequently amongst premature births has long been recognized. Undue obliquity of the uterus has probably some influence, since the early pains might cause the presenting part to hitch against the pelvic brim, and the shoulder to descend. An unusually low attachment of the placenta to the inferior segment of the uterine cavity has been mentioned as a predisposing cause. In consequence of this, the head does not lie so readily in the lower uterine segment, and is apt to slip up into one of the iliac fossæ. This is supposed to explain the frequency of arm presentation in cases of partial or complete placenta prævia. Danyau and Wigand believe that shoulder presentations are favored by irregularity in the shape of the uterine cavity, especially a relative increase in its transverse diameter. This theory has been generally discredited by writers, and it is certainly not susceptible of proof; but it seems far from unlikely that some peculiarity of shape may exist, not capable of recognition, but sufficient to influence the position of the fœtus. How otherwise are we to explain those remarkable cases, many of which are recorded, in which similar malpositions occurred in many successive labors? Thus, Joulin refers to a patient who had an arm presentation in three successive pregnancies, and to another who had shoulder presentation in three out of four labors. Certainly, such constant recurrences of the same abnormality could only be explained on the hypothesis of some very persistent cause, such as that referred to. It is probable that merely accidental causes have most influence in the production of shoulder presentation, such as falls, or undue pressure exerted on the abdomen by badly-fitting or tight stays. Partially transverse positions during pregnancy are certainly much more common than is generally believed, and may often be detected by abdominal palpation. The tendency is for such malpositions to be righted either before labor sets in, or in the early period of labor; but it is quite easy to understand how any persistent pressure, applied in the manner indicated, may perpetuate a position which otherwise would have been only temporary.

Prognosis and Frequency.—According to Churchill's statistics, shoulder presentations occur about once in 260 cases—that is, only slightly less frequently than those of the face. The prognosis to both the mother and child is much more unfavorable; for he estimates that out of 235 cases 1 in 9 of the mothers, and half the children, were lost. The prognosis in each individual case will, of course, vary much with the period of delivery at which the malposition is recognized. If detected early, interference is easy, and the prognosis ought to be good; whereas there are few obstetric difficulties more trying than a case of shoulder presentation in which the necessary treatment has been delayed until the presenting part has been tightly jammed into the cavity of the pelvis.

Diagnosis.—Bearing this fact in mind, the paramount necessity of an accurate diagnosis will be apparent; and it is specially important that we should be able not only to detect that a shoulder or arm is presenting, but that we should, if possible, determine which it is, and how the body and head of the child are placed. The existence of a shoulder presentation is not generally suspected until the first vaginal examination is made during labor. The practitioner will then be struck with the absence of the rounded mass of the fœtal head, and, if the os be open and the membranes protruding, by their elongated form, which is common to this and to other malpresentations. If the presenting part be too high to reach, as is often the case at an early period of labor, an endeavor should at once be made to ascertain the fœtal position by abdominal examination. This is the more important, as it is much more easy to recognize presentations of the shoulder in this way than those of the breech or foot; and at so early a period it is often not only possible, but comparatively easy, to alter the position of the fœtus by abdominal manipulation alone, and thus avoid the necessity of the more serious form of version. The method of detecting a shoulder presentation by examination of the abdomen has already been described (p. 110), and need not be repeated. The chief points to look for are, the altered shape of the uterus, and two solid masses, the head and the breech, one in either iliac fossa. The facility with which these parts may be recognized varies much in different patients. In thin women, with lax abdominal parietes, it is comparatively easy to feel them; while in very stout women it may be impossible. Failing this method, we must rely on vaginal examinations; although, before the membranes are ruptured, and when the presenting part is high in the pelvis, it is not always easy to gain accurate information in this way. The difficulty is increased by the paramount importance of retaining the membranes intact as long as possible. It should be remembered, therefore, that when a presentation of the superior extremity is suspected, the necessary examinations should only be made in the intervals between the pains, when the membranes are lax, and never when they are rendered tense by the uterine contractions.

As either the shoulder, the elbow, or the hand may present, it will be best to describe the peculiarities of each separately, and the means of distinguishing to which side of the body the presenting part belongs.

1. The *shoulder* is recognized as a round smooth prominence, at one point of which may often be felt a sharp edge of the acromion. If the finger can be passed sufficiently high, it may be possible to feel the clavicle, and the spine of the scapula. A still more complete examination may enable us to detect the ribs and the intercostal spaces, which would be quite conclusive as to the nature of the presentation, since there is nothing resembling them in any other part of the body. At the side of the shoulder, the slit formed by the axilla may generally be made out.

Diagnosing the Position of the Child.—In order to ascertain the position of the child we have to find out in which iliac fossa the head lies. This may be done in two ways: 1st, it may generally be felt through the abdominal parietes by palpation; and 2d, since we know that the axilla must always point towards the feet, if it point to the left side the head must lie in the right iliac fossa; if to the right, the head must be placed in the left iliac fossa. Again, the spine of the scapula must correspond to the back of the child, the clavicle to its abdomen; and, by feeling one or other, we know whether we have to do with a dorso-anterior or dorso-posterior position. If we cannot satisfactorily determine the position by these means, it is quite legitimate practice to bring down the arm carefully, so as to examine the hand, which will be easily recognized as right or left. This expedient will decide the point; but it is one which it is better to avoid, if possible, for it not only slightly increases the difficulty of turning, although perhaps not very materially, but the arm might possibly be injured in the endeavor to bring it down.

The only part of the body likely to be taken for the shoulder is the breech; but in that the larger size of the presenting part, the groove in which the genital organs lie, the second prominence formed by the other buttock, together with the spinous processes of the sacral vertebræ, ought to be sufficient to prevent such a mistake.

2. The *elbow* is rarely felt at the os, and may be readily recognized by the sharp prominence of the olecranon, situated between two lesser prominences, the condyles. If we remember that the elbow always points towards the feet, the position of the fœtus can be easily ascertained.

3. The *hand* is easy to recognize, and can only be confounded with the foot, from which it can be distinguished by its borders being of the same thickness, the fingers being wider apart and more readily separable from each other than the toes, and above all by the mobility of the thumb, which can be carried across the palm and placed in apposition with each of the fingers, which is not possible with the great toe.

It is not difficult to tell which hand is presenting. If the hand be in the vagina, or beyond the vulva, and within easy reach, we recognize which it is by laying hold of it as if we were about to shake hands. If the palm lie in the palm of the practitioner's hand, with the two thumbs in apposition, it is the right hand; if the back of the hand, it is the left. Another simple way is, for the practitioner to imagine his own hand placed in precisely the same position as that of the fœtus; and this will readily enable him to verify the previous diagnosis. A simple rule tells us how the body of the child is placed, for, provided we are sure the hand is in a state of supination, the back of the hand points to the back of the child, the palm to its abdomen, the thumb to the head, and the little finger to the feet.

It is perhaps hardly proper to talk of a mechanism of shoulder presentations, since, if left unassisted, they almost invariably lead to the gravest consequences. Still, nature is not entirely at fault even here, and it is well to study the means she adopts to terminate these malpositions.

There are two possible terminations of shoulder presentations. In one, known as "*spontaneous version*," some other part of the fœtus is substituted for that originally presenting; in the other, "*spontaneous evolution*," the fœtus is expelled by being squeezed through the pelvis, without the originally presenting part being withdrawn. It cannot be too strongly impressed on the mind that neither of these can be relied on in practice.

Spontaneous version may occasionally occur before, or immediately after, the rupture of the membranes, when the fœtus is still readily movable within the cavity of the uterus. A few authenticated cases are recorded in which the same fortunate issue took place after the shoulder had been engaged in the pelvic brim for a considerable time, or even after prolapse of the arm; but, of course, the probability of the occurrence is necessarily much lessened under such circumstances. Either the head or the breech may be brought down to the os in place of the original presentation.

The precise mechanism of spontaneous version, or the favoring circumstances, are not sufficiently understood to justify any positive statement with regard to it.

Cazeaux believed that it is produced by partial or irregular contraction of the uterus, one side contracting energetically, while the other remains inert or only contracts to a slight degree. To illustrate how this may effect spontaneous version, let us suppose that the child is lying with the head in the left iliac fossa. Then, if the left side of the uterus should contract more forcibly than the right, it would clearly tend to push the head and shoulder to the right side, until the head came to present instead of the shoulder. But there is no evidence that this occurs, and this explanation must be considered as purely theoretical. The natural moulding action of the uterus, and the greater tendency of the long axis of the child to lie in that of the uterus, no doubt assist the transformation, and much must depend on the mobility of the fœtus in any individual case.

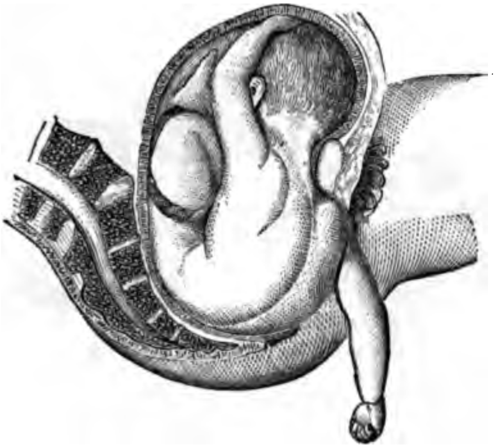
That such changes often take place in the latter weeks of pregnacy, and before labor has actually commenced, is quite certain, and they are probably much more frequent than is generally supposed. When spontaneous version does occur, it is, of course, a most favorable event; and the termination and prognosis of the labor are then the same as if the head or breech had originally presented.

Spontaneous Evolution.—The mechanism of spontaneous evolution, since it was first clearly worked out by Douglas, has been so often and carefully described that we know precisely how it occurs. Although every now and then a case is recorded in which a living child has been born by this means, such an event is of extreme rarity; and there is no doubt of the accuracy of the general opinion that spontaneous evolution can only happen when the pelvis is unusually roomy and the child small, and that it almost necessarily involves the death of the fœtus, on account of the immense pressure to which it is subjected.

Two varieties are described, in one of which the head is first born, in the other the breech; in both the originally presenting arm remains prolapsed. The former is of extreme rarity, and is believed only to have happened with very premature children, whose bodies were small and flexible, and when traction had been made on the presenting arm. Under such circumstances it can hardly be called a natural process, and we may confine our attention to the latter and more common variety.

What takes place is as follows. The presenting arm and shoulder are tightly jammed down, as far as is possible, by the uterine contractions, and the head becomes strongly flexed on the shoulder. As much of the body of the fœtus as the pelvis will contain becomes engaged, and then a movement of rotation occurs, which brings the body of the child nearly into the antero-posterior diameter of the pelvis (Fig. 109).

FIG. 109.



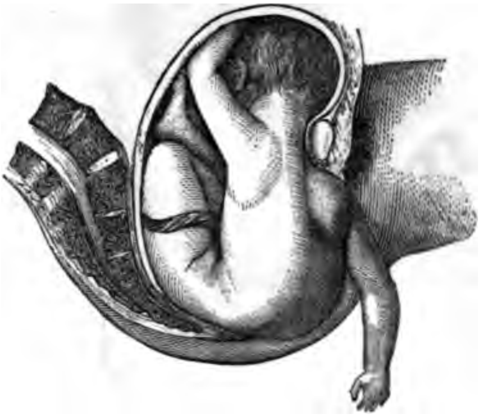
COMMENCING SPONTANEOUS EVOLUTION.

The shoulder now projects under the arch of the pubes, the head lying above the symphysis, and the breech near the sacro-iliac synchondrosis. The shoulder and neck of the child now become fixed points, round which the body of the child rotates, and the whole force of the uterine contractions is expended on the breech. The latter, with the body, therefore, becomes more and more depressed, until, at last, the side of the thorax reaches the vulva, and, followed by the breech and inferior extremities, is slowly pushed out (Fig. 110). As soon as the limbs are born the head is easily expelled.

The enormous pressure to which the body is subjected in this process can readily be understood. As regards the practical bearings of this termination of shoulder presentations, all that need be said is, that if we should happen to meet with a case in which the shoulder and thorax were so strongly depressed that turning was impossible, and in which it seemed that nature was endeavoring to effect evolution, we would be justified in aiding the descent of the breech by traction on the groin, before resorting to the difficult and hazardous operation of embryotomy or decapitation.

Treatment.—It is unnecessary to describe specially the treatment of shoulder presentation, since it consists essentially in performing the operation of turning, which is fully described elsewhere. It is only needful here to insist on the advisability of performing the operation in the way which involves the least interference with the uterus. Hence, if the nature of the case be detected before the membranes are ruptured, an endeavor should be made—and ought generally to succeed—to turn by external manipulation only. If we can succeed in bringing the breech or head over the os in this way, the case will be little more troublesome than an ordinary presentation of these parts. Failing in this, turning by combined external and internal manipulation should be attempted; and the introduction of the entire hand should be reserved for those more troublesome cases in which the waters have long drained away, and in which both these methods are inapplicable.

FIG. 110.



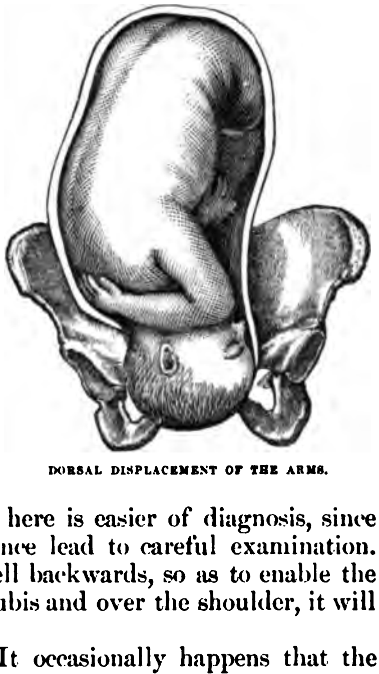
SPONTANEOUS EVOLUTION FARTHER ADVANCED.

Should all these means fail, we have no resource but the mutilation of the child by embryulcia or decapitation, probably the most difficult and dangerous of all obstetric operations.

There are various so-called *complex presentations* in which more than one part of the fœtal body presents. Thus, we may have a hand or a foot presenting with the head, or a foot and hand presenting simultaneously. The former do not necessarily give rise to any serious difficulty, for there is generally sufficient room for the head to pass. Indeed, it is unlikely that either the hand or foot should enter the pelvic brim with the head, unless the head was unusually small, or the pelvis more than ordinarily capacious. As regards treatment, it is, no doubt, advisable to make an attempt to replace the hand or foot by pushing it gently above the head in the intervals between the pains, and maintaining it there until the head be fully engaged in the pelvic cavity. The engagement of the head can be hastened by abdominal pressure, which will prove of great value. Failing this, all we can do is to place the presenting member at the part of the pelvis where it will least impede the labor and be the least subjected to pressure; and that will generally be opposite the temple of the child. As it must obstruct the passage of the head to a certain extent, the application of the forceps may be necessary. When the feet and hands present at the same time, in addition to the confusing nature of the presentation from so many parts being felt together, there is the risk of the hands coming down and converting the case into one of arm presentation. It is the obvious duty of the accoucheur to prevent this by insuring the descent of the feet, and traction should be made on them, either with the fingers or with a lac, until their descent, and the ascent of the hands, are assured.

Dorsal Displacement of the Arm.—In connection with this subject may be mentioned the curious dorsal displacement of the arm first described by Sir James Simpson,[1] in which the fore-arm of the child becomes thrown across and behind the neck. The result is the formation of a ridge or bar, which prevents the descent of the head into the pelvis by hitching against the brim (Fig. 111). The difficulty of diagnosis is very great, for the cause of obstruction is too high up to be felt. But if we meet with a case in which the pelvis is roomy and the pains strong, and yet the head does not descend after an adequate time, a full exploration of the cause is essential. For this purpose we would naturally put the patient under chloroform, and pass the hand sufficiently high. We might then feel the arm in its abnormal position. This was what took place in a case under my own care, in which I failed to get the head through the brim with the forceps, and eventually delivered by turning. The same course was adopted by my friend Mr. Jardine Murray in a similar case.[2] Simpson advises that the arm should be brought down so as to convert the case into an ordinary hand and head presentation. This, if the arm be above the brim, must always be a difficult manœuvre; and I believe that if this unusual cause of dystocia be ascertained, the simpler and more effective plan is podalic version. A similar displacement may cause some difficulty in breech presentations, and after turning (Fig. 112). Delay here is easier of diagnosis, since the obstacle to the expulsion will at once lead to careful examination. By carrying the body of the child well backwards, so as to enable the finger to pass behind the symphysis pubis and over the shoulder, it will generally be easy to liberate the arm.

FIG. 111.



DORSAL DISPLACEMENT OF THE ARMS.

Prolapse of the Umbilical Cord.—It occasionally happens that the umbilical cord falls down past the presenting part (Fig. 113), and is apt to be pressed between it and the walls of the pelvis. The consequence is, that the fœtal circulation is seriously interfered with, and the death of the child from asphyxia is a common result. Hence prolapse of the funis is a very serious complication of labor in so far as the child is concerned.

Frequency.—Fortunately, it is not a very frequent occurrence. Churchill calculates that out of over 105,000 deliveries it was met with once in 240 cases, and Scanzoni once in 254. Its frequency varies much under different circumstances, and in different places. We find from

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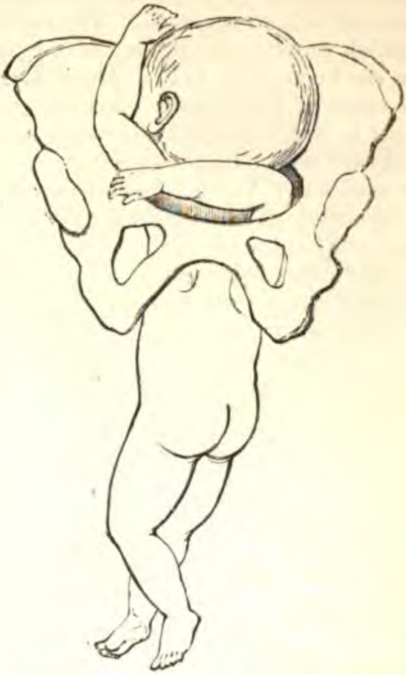
[1] Selected Obstetrical Works, vol. i.

[2] Med. Times and Gaz., 1861.

Churchill's figures a remarkable difference in the proportional number of cases observed in France, England, and Germany, viz., 1 in 446½, 1 in 207½, and 1 in 156, respectively. Great as is the proportion referred to Germany in these figures, it has been found to be exceeded in special districts. Thus, Engelman records 1 out of 94 labors in the Lying-in Hospital at Berlin, and Michaelis 1 in 90 in that of Kiel. These remarkable differences are at first sight not easy to account for. Dr. Simpson suggests, with considerable show of probability, that the difference in frequency in England, France, and Germany may depend on the varying positions in which lying-in women are placed during labor in each country. In France, where, although the patient is laid on her back, the pelvis is kept elevated, the complication occurs least frequently; in England, where she lies on her side, more often; and in Germany, where she is placed on her back with her shoulders raised, most often. The special frequency of prolapsed funis in certain districts, as in Kiel, is supposed by Engelman[1] to depend on the prevalence of rickets, and consequently of deformed pelvis, which, we shall presently see, is probably one of the most frequent and important causes of the accident.

FIG. 112.



DORSAL DISPLACEMENT OF THE ARMS IN FOOTLING PRESENTATIONS.

Prognosis.—With regard to the danger attending prolapsed funis, as far as the mother is concerned, it may be said to be altogether unimportant; but the universal experience of obstetricians points to the great risk to which the child is subjected. Scanzoni calculates that 45 per cent. only of the children were saved; Churchill estimated the number at 47 per cent.: thus, under the most favorable circumstances, this complication leads to the death of more than half the children. Engelman found that out of 202 vertex presentations only 36 per cent. of the children survived. The mortality was, however, not nearly so great in other presentations, for 68 per cent. of the cases in which the child presented with the feet were saved, and 50 per cent. in original shoulder presentations. The reason of this remarkable difference is, doubtless, that in vertex presentations the head fits the pelvis much more completely, and subjects the cord to much greater pressure; while in other presentations the pelvis is less completely filled, and the interference with the circulation in the cord is not so great. Besides, in the former case the complication is detected early, and the necessary treatment sooner adopted.

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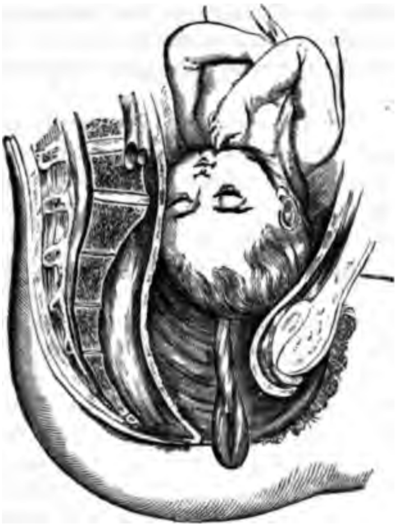
[1] Amer. Journ. of Obst., vol. vi.

FIG. 118.



PROLAPSE OF THE UMBILICAL CORD.

The fœtal mortality is considerably greater in first labors; a result to be expected on account of the greater resistance of the soft parts, and the consequent prolongation of the labor.

Causes.—The causes of prolapse of the funis are any circumstances which prevent the presenting part accurately fitting the pelvic brim. Hence it is much more frequent in face, breech, or shoulder than in vertex presentations, and is relatively more common in footling and shoulder presentations than in any other. Amongst occasional accidental predisposing causes may be mentioned—early ruptures of the membranes, especially if the amount of liquor amnii be excessive, as the sudden escape of the fluid washes down the cord; undue length of the cord itself; or an unusually low placental attachment. Engelman attaches great importance to slight contraction of the pelvis, and states that in the Berlin Lying-in Hospital, where accurate measurements of the pelvis were taken in all cases, it was almost invariably found to exist. The explanation is evident, since one of the first results of pelvic contraction is to prevent the ready engagement of the presenting part in the pelvic brim.

The *diagnosis* of cord presentation is generally devoid of difficulty; but if the membranes are still unruptured, it may not always be quite easy to determine the precise nature of the soft structures felt through them, as they recede from the touch. If the pulsations of the cord can be felt through the membranes, all difficulty is removed. After the membranes are ruptured, there is nothing that it can well be mistaken for.

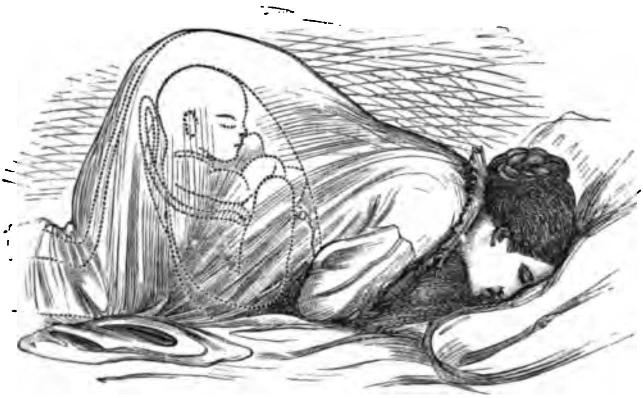
The important point to determine in such a case is whether the cord be pulsating or not; for if pulsations have entirely ceased, the inference is that the child is dead, and the case may then be left to nature without further interference. It is of importance, however, to be careful; for, if the examination be made during a pain, the circulation might be only temporarily arrested. The examination, therefore, should be made during an interval, and a loop of the cord pulled down, if necessary, to make ourselves absolutely certain on this point.

The amount of the prolapse varies much. Sometimes only a small knuckle of the cord, so minute as to escape observation, is engaged between the pelvis and presenting part. Under such circumstances the child may be sacrificed without any suspicion of danger having arisen. More often the amount prolapsed is considerable; sometimes so as to lie in the vagina in a long loop, or even to protrude altogether beyond it.

Treatment.—In the treatment the great indication is to prevent the cord from being unduly pressed on, and all our endeavors must have this object in view. If the presentation be detected before the full dilatation of the cervix, and when the membranes are unruptured, we must try to keep the cord out of the way; to carefully preserve the membranes intact as long as possible, since the cord is tolerably protected as long as it is surrounded by the liquor amnii; and to secure the complete dilatation of the os, so that the presenting part may engage rapidly and completely.

Postural Treatment.—Much may be done at this time by the postural treatment, which we chiefly owe to the ingenuity of Dr. Gaillard Thomas, of New York, whose writings familiarized the profession with it, although it appears that a somewhat similar plan had been occasionally adopted previously. Dr. Thomas's method is based on the principle of causing the cord to slip back into the uterine cavity by its own weight. For this purpose the patient is placed on her hands and knees, with the hips elevated, and the shoulders resting on a lower level (Fig. 114). The cervix is then no longer the most dependent portion of the uterus, and the anterior wall of the uterus forms an inclined plane down which the cord slips. The success of this manœuvre is sometimes very great, but by no means a It is most likely to succeed, of course, when the membranes are unruptured. If, when adopted, the cord slip away, and the os be sufficiently dilated, the membranes may be ruptured, and engagement of the head produced by properly applied uterine pressure. Sometimes the position is so irksome that it is impossible to resort to it. Postural treatment is not even then altogether impossible, for by placing the patient on the side opposite to the prolapse, so as to relieve it as much as possible from pressure, and at the same time elevating the hips by a pillow, the cord may slip back. Even after the membranes are ruptured, postural treatment in one form or another may succeed; and, as it is simple and harmless, it should certainly be always tried.

FIG 114.

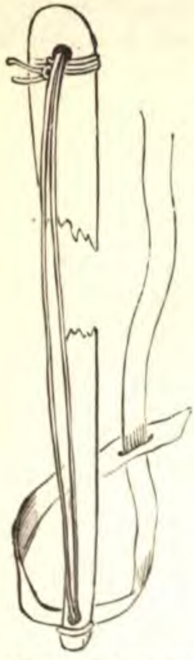


POSTURAL TREATMENT OF PROLAPSE OF THE CORD.

Artificial Reposition.—Failing by postural treatment, it is quite legitimate to make an attempt to place the cord beyond the reach of dangerous pressure by other methods. Unfortunately, reposition is too often disappointing, difficult to effect, and very frequently, even when apparently successful, shortly followed by a fresh descent of the cord. Provided the os be fully dilated, and the presenting vertex engaged in the pelvis (for reposition may be said to be hopeless when any other part presents), perhaps the best way is to attempt it by the hand alone. Probably the simplest and most effectual method is that recommended by McClintock and Hardy, who advise that the patient should lie on the same side as the prolapsed cord, which should then be drawn towards the pubes as being the shallowest part of the pelvis. Two or three fingers may then be used to push the cord past the head, and as high as they can reach. They must be kept in the pelvis until a pain comes on, and then very gently withdrawn, in the hope that the cord may remain behind. During the pain external pressure may very properly be applied to favor descent of the head. This manœuvre may be repeated during several successive pains, and may eventually succeed. The attempt to hook the cord over the fœtal limbs, or to place it in the hollow of the neck, recommended in many works, involves so deep an introduction of the hand that it is obviously inapplicable.

Various complex instruments have been invented to aid reposition (Fig. 115), but, even if we possessed them, they are not likely to be at hand when the emergency arises. A simple instrument may be improvised out of an ordinary male elastic catheter, by passing the two ends of a piece of string through it, so as to leave a loop emerging from the eye of the catheter. This is passed through the loop of prolapsed cord, and then fixed in the eye of the catheter by means of the stilette. The cord is then pushed up into the uterine cavity by the catheter, and liberated by withdrawing the stilette. Another simple instrument may be made by cutting a hole in a piece of whalebone. A piece of tape is then passed through the loop of the cord, and the ends threaded through the eye cut in the whalebone. By tightening the tape the whalebone is held in close apposition to the cord, and the whole is passed as high as possible into the uterine cavity. The tape can easily be liberated by pulling one end. If preferred, the cord can be tied to the whalebone, which is left in utero until the child is born. Nothing need be said as to the various other methods adopted for keeping up the cord, such as the insertion of pieces of sponge, or tying the cord in a bag of soft leather, since they are generally admitted to be quite useless.

Fig. 115.



BRAUN'S APPARATUS FOR REPLACING THE CORD.

It only too often happens that all endeavors at reposition fail. The subsequent treatment must then be guided by the circumstances of the case. If the pelvis be roomy, and the pains strong, especially in a multipara, we may often deem it advisable to leave the case to nature, in the hope that the head may be pushed through before pressure on the cord has had time to prove fatal to the child. Under such circumstances the patient should be urged to bear down, and the descent of the head promoted by uterine pressure, so as to get the second stage completed as soon as possible. If the head be within easy reach, the application of the forceps is quite justifiable, since delay must necessarily involve the death of the child. During this time the cord should be placed, if possible, opposite one or other sacro-iliac synchondrosis, according to the position of the head, as the part of the pelvis where there is most room, and where the pressure would consequently be least prejudicial. If we have to do with a case in which the head has not descended into the pelvis, and postural treatment and reposition have both failed, provided the os be fully dilated, and other circumstances be favorable, turning would undoubtedly offer the best chance to the child. This treatment is strongly advocated by Engelman, who found that 20 per cent. of the children delivered in this way were saved. There can be no question that, so far as the interests of the child are concerned, it is, under the circums[illegible]dicated, by far the best expedient. Turning, however, is by [illegible]ays devoid of a certain risk to the mother, and the performance of the operation, in any particular case, must be left to the judgment of the practitioner. A fully-dilated os, with membranes unruptured, so that version could be performed by the combined method without the introduction of the hand into the uterus, would be unquestionably the most favorable state. If it be not deemed proper to resort to it, all that can be done is to endeavor to save the cord from pressure as much as possible, by one or other of the methods already mentioned.

CHAPTER IX.

PROLONGED AND PRECIPITATE LABORS.

AMONG the difficulties connected with parturition there are none of more frequent occurrence, and none requiring more thorough knowledge of the physiology and pathology of labor, than those arising from deficient or irregular action of the expulsive powers. The importance of studying this class of difficult labors will be seen when we consider the numerous and very diverse causes which produce them.

That the mere prolongation of labor is in itself a serious thing, is becoming daily more and more an acknowledged axiom of midwifery practice; and its recognition is evident when we contrast the statistical returns of such institutions as the Rotunda Lying-in Hospital of late years, with those which were published some twenty or thirty years ago. It may be fairly assumed that the practice of the distinguished heads of that well-known school represents the most advanced and scientific opinion of the day. When we find that less than thirty years ago the forceps were not used more than once in 310 labors, while according to the report for 1873 the late Master applied them once in 8 labors, it is apparent how great is the change which has taken place.

Effects of Prolonged Labor.—Labor may be prolonged from an immense number of causes, the principal of which will require separate study. Some depend simply on defective or irregular action of the uterus; others act by opposing the expulsion of the child, as, for example, undue rigidity of the parturient passages, narrowing from tumors, bony deformity, and the like. Whatever the source of delay, a train of formidable symptoms are developed, which are fraught with peril both to the mother and the child. As regards the mother, they vary much in degree and in the rapidity with which they become established. In many cases, in which the action of the uterus is slight, it may be very long before serious results follow; while in others, in which a strongly-acting organ is exhausting itself in futile endeavors to overcome an obstacle, the worst signs of protraction may come on with comparative rapidity.

The stage of labor in which delay occurs, moreover, has a marked effect in the production of untoward symptoms. It is a well-established fact that prolongation is of comparatively small consequence to either the mother or child in the first stage, when the membranes are still intact, and when the soft parts of the mother, as well as the body of the child, are protected by the liquor amnii from injurious pressure; whereas it becomes of the utmost importance to both as soon as the head has entered the pelvis, when the uterus is strongly excited by reflex stimulation, when the maternal soft parts are exposed to continuous pressure, and when the tightly-contracted uterus presses firmly on the fœtus and obstructs the placental circulation. It is in reference to the latter class of cases that the change of practice, already alluded to, has taken place, with the most beneficial results both to the mother and child, and especially to the latter.

It must not be assumed, however, that prolongation of labor is of no consequence until the second stage has commenced. The fallacy of such an opinion was long ago shown by Simpson, who proved, in the most conclusive way, that both the maternal and fœtal mortality were greatly increased in proportion to the entire length of the labor; and all practical accoucheurs are familiar with cases in which symptoms of gravity have arisen before the first stage is concluded. Still, relatively speaking, the opinion indicated is undoubtedly correct.

In the present chapter we have to do only with those causes of delay connected with the expulsive powers. Inasmuch, however, as the injurious effects of protraction are similar in kind, whatever be the cause, it will save needless repetition if we consider, once for all, the train of symptoms that arise whenever labor is unduly prolonged.

As long as the delay is in the first stage only, with rare exceptions, no symptoms of real gravity arise for a length of time; it may be even for days. There is often, however, a partial cessation of the pains, which, in consequence of temporary exhaustion of nervous force, may even entirely disappear for many consecutive hours. Under such circumstances, after a period of rest, either natural or produced by suitable sedatives, they recur with renewed vigor.

A similar temporary cessation of the pains may often be observed after the head has passed through the os uteri, to be also followed by renewed vigorous action after rest. But now any such irregularity must be much more anxiously watched. In the majority of cases any marked alteration in the force and frequency of the pains at this period indicates a much more serious form of delay, which in no long time is accompanied by grave general symptoms. The pulse begins to rise, the skin to become hot and dry, the patient to be restless and irritable. The longer the delay, and the more violent the efforts of the uterus to overcome the obstacle, the more serious does the state of the patient become. The tongue is loaded with fur, and, in the worst cases, dry and black; nausea and vomiting often become marked; the vagina feels hot and dry, and the ordinary abundant mucous secretion is absent; in severe cases it may be much swollen, and, if the presenting part be firmly impacted, a slough may even form. Should the patient still remain undelivered, all these symptoms would become greatly intensified, the vomiting incessant, the pulse rapid and almost imperceptible, low muttering delirium would supervene, and the patient eventually die with all the worst indications of profound irritation and exhaustion.

So formidable a train of symptoms, or even the slighter degrees of them, should never occur in the practice of the skilled obstetrician ; and it is precisely because a more scientific knowledge of the process of parturition has taught the lesson that, under such circumstances, prevention is better than cure, that earlier interference has become so much more the rule.

Those who taught that nothing should be done until nature had had every possible chance of effecting delivery, and who, therefore, allowed their patients to drag on in many weary hours of labor, at the expense of great exhaustion to themselves and imminent risk to their offspring, made much capital out of the time-honored maxim that " meddlesome midwifery is bad." When this proverb is applied to restrain the rash and uninstructed interference of the ignorant, it is of undeniable value ; but when it is quoted to prevent the scientific action of the experienced, who know precisely when and why to interfere, and who have acquired the indispensable mechanical skill, it is sadly misapplied.

State of the Uterus in Protracted Labor.—The nature of the pains and the state of the uterus, in cases of protracted labor, are peculiarly worthy of study, and have been very clearly pointed out by Dr. Braxton Hicks.[1] He shows that when the pains have apparently fallen off and become few and feeble, or have entirely ceased, the uterus is in a state of continuous or tonic contraction, and that the irritation resulting from this is the chief cause of the more marked symptoms of powerless labor. If, in a case of the kind, the uterus be examined by palpation, it will be found firmly contracted between the pains. The correctness of this observation is beyond question, and it will, no doubt, often be an important guide in treatment. Under such circumstances instrumental interference is imperatively demanded.

In considering the causes of protracted labor, it will be well first to discuss those which affect the expulsive powers alone, leaving those depending on morbid states of the passages for future consideration ; bearing in mind, however, that the results, as regards both the mother and the child, are identical, whatever may be the cause of delay.

Constitution of the Patient.—The general constitutional state of the patient may materially influence the force and efficiency of the pains. Thus, it not unfrequently happens that they are feeble and ineffective in women of very weak constitution, or who have been much exhausted by debilitating disease. Cazeaux points out that the effects of such general conditions are often more than counterbalanced by flaccidity and want of resistance of the tissues, so that there is less obstacle to the passage of the child. Hence in phthisical patients, reduced to the last stage of exhaustion, the labor is not unfrequently surprisingly easy. Long residence in tropical climates has an unquestionable effect in causing uterine inertia, in consequence of the enfeebled nervous power it produces. It is a common observation that European residents in India are peculiarly apt to suffer from post-partum hemorrhage from this cause. The general mode of life of patients has an unquestionable effect; and it is certain that deficient and irregular uterine action is more common in women of the higher ranks of society, who lead luxurious, enervating lives, than in women whose habits are of a more healthy character.

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[1] Obst. Trans., vol. ix.

Frequent Child-bearing.—Tyler Smith lays much stress on frequent child-bearing as a cause of inertia, pointing out that a uterus which has been very frequently subjected to the changes connected with pregnancy is unlikely to be in a typically normal condition. It is doubtful, however, whether the uterus of a perfectly healthy woman is affected in this way; certainly, if child-bearing have undermined her general health the labors are likely to be modified also.

Age of Patient.—Age has a decided effect. In the very young the pains are apt to be irregular, on account of imperfect development of the uterine muscle. Labor taking place for the first time in women advanced in life is also apt to be tedious, but not by any means so invariably as is generally believed. The apprehensions of the patient are often agreeably falsified, and where delay does occur it is probably more often referable to rigidity and toughness of the parturient passages than to feebleness of the pains.

Disorders of the Intestines.—Morbid states of the primæ viæ frequently cause irregular, painful, and feeble contractions. A loaded state of the rectum has often a remarkable influence, as evidenced by the sudden and distinct change in the character of the labor which often follows the use of suitable remedies. Undue distension of the bladder often acts in the same way, more especially in the second stage. When the urine has been allowed to accumulate unduly, the contraction of the accessory muscles of parturition often causes such intense suffering, by compressing the distended viscus, that the patient is absolutely unable to bear down. Hence the labor is carried on by uterine contractions alone, slowly, and at the expense of much suffering. A similar interference with the action of the accessory muscles is often produced by other causes. Thus, if labor comes on when the patient is suffering from bronchitis or other chest disease, she may be quite unable to fix the chest by a deep inspiration, and the diaphragm and other respiratory muscles cannot act. In the same way the abdominal muscles may be prevented from acting when the abdomen is occupied by an ovarian tumor, or by ascitic fluid.

Mental conditions have a very marked effect. This is so common that it is familiar to the merest beginner in midwifery practice. The fact that the pains often diminish temporarily on the entrance of the accoucheur is known to every nurse; and so also undue excitement, the presence of too many people in the room, over-much talking, have often the same prejudicial effect. Depression of mind, as in unmarried women, and fear and despondency in women who have looked forward with apprehension to their labor, are also common causes of irregular and defective action.

Excessive Amount of Liquor Amnii.—Undue distension of the uterus from an excessive amount of liquor amnii not unfrequently retards the first stage, by preventing the uterus from contracting efficiently. When this exists, the pains are feeble and have little effect in dilating the cervix beyond a certain degree. This cause may be suspected when undue protraction of the first stage is associated with an unusually large size and marked fluctuation of the uterine tumor, through which the fœtal limbs cannot be made out on palpation. On vaginal examination, the lower segment of the uterus will be found to be very rounded and prominent, while the bag of membranes will not bulge through the os during the acme of the pain.

Malpositions of the Uterus.—A somewhat similar cause is undue obliquity of the uterus, which prevents the pains acting to the best mechanical advantage, and often retards the entry of the presenting part into the brim. The most common variety is anteversion, resulting from excessive laxity of the abdominal parietes, which is especially found in women who have borne many children. Sometimes this is so excessive that the fundus lies over the pubes, and even projects downwards towards the patient's knees. The consequence is that when labor sets in, unless corrective means be taken, the pains force the head against the sacrum, instead of directing it into the axis of the pelvic inlet. Another common deviation is lateral obliquity—a certain degree of which exists in almost all cases, but sometimes it occurs to an excessive degree. Either of these states can readily be detected by palpation and vaginal examination combined. In the former the os may be so high up, and tilted so far backwards, that it may be at first difficult to reach it at all.

Irregular and Spasmodic Pains.—Besides being feeble, the uterine contractions, especially in the first stage, are often irregular and spasmodic, intensely painful, but producing little or no effect on the progress of the labor. This kind of case has been already alluded to in treating of the use of anæsthetics (p. 266), and is very common in highly nervous and emotional women of the upper classes. Such irregular contractions do not necessarily depend on mental causes alone, and they are often produced by conditions producing irritation, such as loaded bowels, too early rupture of the membranes, and the like. Dr. Trenholme, of Montreal,[1] believes that such irregular pains most frequently depend on abnormal adhesions between the decidua and the uterine walls, which interfere with the proper dilatation of the os, and he has related some interesting cases in support of this theory.

Treatment.—The mere enumeration of these various causes of protracted labor will indicate the treatment required. Some of them, such as the constitutional state of the patient, age, or mental emotion, it is, of course, beyond the power of the practitioner to influence or modify; but in every case of feeble or irregular uterine action a careful investigation should be made, with the view of seeing if any removable cause exist. For example, the effect of a large enema, when we suspect the existence of a loaded rectum, is often very remarkable; the pains frequently almost immediately changing in character, and a previously lingering labor being rapidly terminated. Excessive distension of the uterus can only be treated by artificial evacuation of the liquor amnii; and after this is done, the character of the pains often rapidly changes.

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[1] Obst. Trans., 1873.

If we have reason to suspect the existence of the morbid adhesions between the membranes and the uterine walls mentioned by Dr. Trenholme, an endeavor must be made to separate them by sweeping the finger or a flexible catheter round the internal margin of the os, or puncturing the sac. The former expedient has been advocated by Dr. Inglis,[1] as a means of increasing the pains when the first stage is very tedious, and I have often practised it with marked success. Trenholme's observation affords a rationale of its action. The manœuvre itself is easily accomplished, and, provided the os be not very high in the pelvis, without any pain or discomfort to the patient.

Attention should always be paid to remedying any deviation of the uterus from its proper axis. If this be lateral, the proper course to pursue is to make the patient lie on the opposite side to that towards which the organ is pointing. In the more common anterior deviation, the patient should lie on her back, so that the uterus may gravitate towards the spine, and a firm abdominal bandage should be applied. This prevents the organ from falling forwards, while its pressure stimulates the muscular fibres to increased action; hence it is often very serviceable when the pains are feeble, even if there be no anteversion.

In a frequent class of cases, especially in the first stage, the pains diminish in force and frequency from fatigue, and the indication then is to give a temporary rest, after which they recommence with renewed vigor. Hence an opiate, such as 20 minims of Battley's solution, which often acts quickest when given in the form of enema, is frequently of the greatest possible value. If this secure a few hours' sleep, the patient will generally awake much refreshed and invigorated. It is important to distinguish this variety of arrested pain from that dependent on actual exhaustion; and this can be done by attention to the general condition of the patient, and especially by observing that the uterus is soft and flaccid in the intervals between the pains, and that there is none of the tonic contraction, indicated by persistent hardness of the uterine parietes, the importance of which has been pointed out by Dr. Hicks. When the pains are irregular, spasmodic, and excessively painful, without producing any real effect, opiates are also of great service; and it is under these circumstances that chloral is especially valuable.

Still, a large number of cases will arise in which the absence of all removable causes has been ascertained, and in which the pains are feeble and ineffective. We must now proceed to discuss their management. The fault being the want of sufficient contraction, the first indication is to increase the force of the pains. Here the so-called *oxytocic* remedies come into action; and, although a large number of these have been used from time to time, such as borax, cinnamon, and galvanism, practically the only one in which any reliance is now placed is the ergot of rye. This has long been the favorite remedy for deficient uterine action, and it is undoubtedly a very powerful stimulant of the uterine fibres. It has, however, very serious disadvantages, which have been recognized by the ablest practitioners, and it is very questionable whether the risks to both mother and child do not more than counterbalance any advantages attending its use. The ergot is given in doses of 15 or 20 grains of the freshly powdered drug diffused in warm water, or in the more convenient form of the liquid extract, in doses of from 20 to 30 minims. In about fifteen minutes after its administration, the pains generally increase greatly in force and frequency, and if the head be low in the pelvis, and if the soft parts offer no resistance, the labor may be rapidly terminated.

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[1] Sydenham Society's Year-Book, 1869.

Were its use always followed by this effect, there would be little or no objection to its administration. The pains, however, are different from those of natural labor, being strong, persistent, and constant. Its effect, indeed, is to produce that very state of tonic and persistent uterine contraction which has been already pointed out as one of the chief dangers of protracted labor. Hence, if, from any cause, the exhibition of the doses be *not* followed by rapid delivery, a condition is produced which is serious to the mother, and which experience has shown to be extremely perilous to the child, on account of the tonic contraction of the muscular fibres obstructing the utero-placental circulation. Dr. Hardy found that soon the fœtal pulsations fall to 100, and, if delivery be long delayed, they commence to intermit. He also observed that when this occurred the child was always born dead, and found that the number of still-born children after ergot has been exhibited was very large, for out of 30 cases in which he gave it in tedious labor, only 10 of the children were born alive. Nor is its use by any means free from serious danger to the mother; a not inconsiderable number of cases of rupture of the uterus have been attributed to its incautious use. Hence, if it is to be given at all, it is obvious that it must be with strict limitations, and after careful consideration.

The cardinal point to remember is that it is absolutely contraindicated unless the absence of all obstacles to rapid delivery has been ascertained. Hence it is only allowable when the first stage is over, and the os fully dilated, when the experience of former labors has proved the pelvis to be of ample size, and when the perinæum is soft and dilatable. Perhaps, as has been suggested, the administration of small doses of from 5 to 10 minims of the liquid extract every ten minutes, until more energetic action set in, might obviate some of these risks.

Manual Pressure.—If we had no other means of increasing defective uterine contractions at our disposal, and if the choice lay only between the use of ergot and instrumental delivery, there might not be so much objection to a cautious use of the drug in suitable cases. We have, however, a means of increasing the force of the uterine contractions so much more manageable and so much more resembling the natural process, that I believe it to be destined to entirely supersede the administration of ergot. This is the application of manual pressure to the uterus through the abdomen, an expedient that has of late years been much used in Germany, and has begun to be employed in English practice. I believe, therefore, that ergot should be chiefly used for the purpose of exciting uterine contraction after delivery, when its peculiar property of promoting tonic contraction is so valuable, and that it should rarely, if at all, be employed before the birth of the child.

The systematic use of uterine pressure as an oxytocic was first prominently brought under the notice of the profession by Credé, under the name of "Expressio Fœtus," although it has been used in various forms from time immemorial. There are some curious obstetric customs among various nations, which probably arose from a recognition of its value; as, for example, the mode of delivery adopted among the Kalmucks, where the patient sits at the foot of the bed, while a woman, seated behind her, seizes her round the waist and squeezes the uterus during the pains. Amongst the Japanese, Siamese, North American Indians, and many other nations, pressure, applied in various ways, is habitually used.

Credé maintains that it is possible to effect the complete expulsion of the child by properly applied pressure, even when the pains are entirely absent. Strange as this may appear to those who are not familiar with the effects of pressure, I believe that, under exceptional circumstances, when the pelvis is very capacious and the soft parts offer but slight resistance, it can be done. I have delivered in this way a patient whose friends would not permit me to apply the forceps, when I could not recognize the existence of any uterine contraction at all, the fœtus being literally squeezed out of the uterus. It is not, however, as replacing absent pains, but as a means of intensifying and prolonging the effects of deficient and feeble ones, that pressure finds its best application.

Its effects are often very remarkable, especially in women of slight build, where there is but little adipose tissue in the abdominal walls, and not much resistance in the pelvic tissues. If the finger be placed on the head while pressure is applied to the uterus, a very marked descent can readily be felt, and not unfrequently two or three applications will force the head on to the perinæum. There are, however, certain conditions when it is inapplicable, and the existence of which should contra-indicate its use. Thus, if the uterus seem unusually tender on pressure, and, *a fortiori*, if the tonic contraction of exhaustion be present, it is inadmissible. So also if there be any obstruction to rapid delivery, either from narrowing of the pelvis or rigidity of the soft parts, it should not be used. The cases suitable for its application are those in which the head or breech is in the pelvic cavity, and the delay is simply due to a want of sufficiently strong expulsive action.

It may be applied in two ways. The better is to place the patient on her back at the edge of the bed, and spread the palms of the hands on either side of the fundus and body of the uterus, and, when a pain commences, to make firm pressure during its continuance downwards and backwards in the direction of the pelvic inlet. As the contraction passes off, the pressure is relaxed, and again resumed when a fresh pain begins. In this way each pain is greatly intensified, and its effect on the progress of the fœtus much increased. It is not essential that the patient should lie on her back. A useful, although not so great, amount of pressure can be applied when she is lying in the ordinary obstetric position on her left side, the left hand being spread out over the fundus, leaving the right free to watch the progress of the presenting part per vaginam.

The special value of this method of treating ineffective pains is, that the amount and frequency of the pressure are completely within the control of the practitioner, and are capable of being regulated to a nicety in accordance with the requirements of each particular case. It has the peculiar advantage of closely imitating the natural means of delivery, and of being absolutely without risk to the child; nor is there any reason to think that it is capable of injuring the mother. At least I may safely say that, out of the large number of cases in which I have used it, I have never seen one in which I had the least reason to think that it had proved hurtful. Of course it is essential not to use undue roughness; firm and even strong pressure may be employed, but that can be done without being rough; and, as its application is always intermittent, there is no time for it to inflict any injury on the uterine tissues.

Pressure is specially valuable, as has been said, when it is desirable to intensify feeble pains. It may, however, be serviceably employed when the pains are altogether absent, to imitate and replace them, provided there be nothing but the absence of a *vis a tergo* to prevent speedy delivery. In such cases an endeavor should be made to imitate the pains as closely as possible, by applying the pressure at intervals of four or five minutes, and entirely relaxing it after it has been applied for a few seconds.

Instrumental Delivery.—When all these means fail, we have then left the important resource of instrumental aid; and we have now to consider the indications for the use of the forceps under such circumstances. It has been already pointed out that professional opinion on this point has been undergoing a marked change, and that it is now recognized as an axiom by the most experienced teachers that, when we are once convinced that the natural efforts are failing, and are unlikely to effect delivery, except at the cost of long delay, it is far better to interfere soon rather than late, and thus prevent the occurrence of the serious symptoms accompanying protracted labor. This is, of course, a practice directly opposed to that so long taught in our standard works, in which instrumental interference was strictly prohibited unless all hope of natural delivery was at an end, and in which the commencement at least, if not the complete establishment, of symptoms of exhaustion, was considered to be the only justification for the application of forceps in lingering labor.

The reasons which have led the late distinguished Master of the Rotunda Hospital to a more frequent use of the forceps are so well expressed in his report for 1872, that I venture to quote them, as the best justification for a practice that many practitioners of the older school will, no doubt, be inclined to condemn as rash and hazardous. He says,[1] "Our established rule is that so long as nature is able to effect its purpose without prejudice to the constitution of the patient, danger to the soft parts, or the life of the child, we are in duty bound to allow the labor to proceed; but as soon as we find the natural efforts are beginning to fail, and after having tried the milder means for relaxing the parts or stimulating the uterus to increased action, and the desired effects not being produced, we consider we are in duty bound to adopt still prompter measures, and by our timely assistance relieve the sufferer from her distress and her offspring from an imminent death. Why, may I ask, should we permit a fellow-creature to undergo hours of torture when we have the means of relieving them within our reach? Why should she be allowed to waste her strength, and incur the risks consequent upon long pressure of the head on the soft parts, the tendency to inflammation and sloughing, or the danger of rupture, not to speak of the poisonous miasm which emanates from an inflammatory state of the passages, the result of tedious labor, and which is one of the fertile causes of puerperal fever and all its direful effects, attributed by some to the influence of being confined in a large maternity, and not to its proper source, *i.e.*, the labor being allowed to continue till inflammatory symptoms appear? The more we consider the benefits of timely interference, and the good results which follow it, the more are we induced to pursue the system we have adopted, and to inculcate to those we are instructing the advantages to be gained by such practice, both in saving the life of the child as well as securing the greater safety of the mother." It would be impossible to put the matter in a stronger or a clearer light, and I feel confident that these views will be endorsed by all who have adopted the more modern practice.

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[1] Fourth Clinical Report of the Rotunda Lying-in Hospital for the Year ending 1872.

The great diminution of infantile mortality that accompanies a more frequent resort to the forceps is one of the strongest arguments in its favor, and one that has been little dwelt on. No one will deny that the practitioner owes a duty to the child as well as to the mother; although this fact has long been strangely overlooked. Taking all classes of labors together, 1 out of every 20 to 30 children is still-born. This is about the average proportion among those who leave the second stage as long as possible to the natural efforts; and, if we remember the continuous pressure to which the fœtus is subjected when once it has passed through the os uteri, it is not astonishing that so many children should be lost during parturition. Nothing more convincingly shows the conservative effects of early interference as regards the child than the results of the practice of those who resort to it. Amongst the most remarkable statistics on this point are those contributed by Dr. Hamilton,[1] of Falkirk, whose papers are well worthy of study. That gentleman uses the forceps on an average once in every seventh or eighth case, and he thus delivered 731 successive children without a single still-birth, a result which he justly describes as altogether unprecedented in obstetric history.

Attendant Dangers.—It is, of course, right that we should consider the opposite point of view, and reflect on the possible disadvantages which may attend the timely interference advocated. Here I should point out that I am now talking only of the use of the forceps in simple inertia, when the head is low in the pelvic cavity, and when all that is wanted is a slight *vis a fronte* to supplement the deficient *vis a tergo*. The use of the instrument when the head is arrested high in the pelvis, or in cases of deformity, or before the os uteri is completely expanded, is an entirely different and much more serious matter, and does not enter into the present discussion. The facts just stated as regards the child put it beyond question that—from that point of view at least—the dangers of delay are infinitely greater than those of action. It only then remains for us to inquire if there be sufficient risk to the mother to counterbalance that of delay. It will, of course, be conceded by all, that the forceps in the hands of a coarse, bungling, and ignorant practitioner, who has not studied the proper mode of operating, may easily inflict serious damage. The possibility of inflicting injury in this way should act as a warning to every obstetrician to make himself thoroughly acquainted with the proper mode of using the instrument, and to acquire the manual skill which practice and the study of the mechanism of delivery will alone give in perfection; but it can hardly be used as an argument against its use. If that were admitted, surgical interference of any kind would be tabooed, since there is none that ignorance and incapacity might not render dangerous.

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[1] Medico-Clin. [illegible] viii. and xlix.

Assuming, therefore, that the practitioner is able to apply the forceps skilfully, is there any inherent danger in their use? I think all who dispassionately consider the question must admit that, in the class of cases alluded to, the operation is so simple that its disadvantages cannot for a moment be weighed against those attending protraction and its consequences. Against this conclusion statistics may possibly be quoted, such as those of Churchill, who estimated that 1 in 20 mothers delivered by forceps in British practice were lost. But the fallacy of such figures is apparent on the slightest consideration; and by no one has this been more conclusively shown than by Drs. Hicks and Phillips in their paper on tables of mortality after obstetric operations,[1] where it is proved in the clearest manner that such results are due not to the treatment, but rather to the fact that the treatment was so long delayed.

It is quite impossible to lay down any precise rule as to when the forceps should be used in uterine inertia. Each case must be treated on its own merits, and after a careful estimate of the effect of the pains. The rules generally taught were, that the head should be allowed to rest at or near the perinæum for a number of hours, and that interference was contra-indicated if the slightest progress were being made. It is needless to say that both these rules are incompatible with the views I have been inculcating, and that any rule based upon the length of time the second stage of labor has lasted must necessarily be misleading. What has to be done, I conceive, is, to watch the progress of the case anxiously after the second stage has fairly commenced, and to be guided by an estimate of the advance that is being made and the character of the pains, bearing in mind that the risk to the mother, and still more to the child, increases seriously with each hour that elapses. If we find the progress slow and unsatisfactory, the pains flagging and insufficient, and incapable of being intensified by the means indicated, then, provided the head be low in the pelvis, it is better to assist at once by the forceps, rather than to wait until we are driven to do so by the state of the patient.

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[1] Obst. Trans., vol. xiii.

Undue rapidity of labor is certainly more uncommon than its converse, but still it is by no means of unfrequent occurrence. Most obstetric works contain a formidable catalogue of evils that may attend it, such as rupture of the cervix, or even of the uterus itself, from the violence of the uterine action; laceration of the perinæum from the presenting part being driven through before dilatation has occurred; fainting from the sudden emptying of the uterus; hemorrhage from the same cause. With regard to the child it is held that the pressure to which it is subjected, the sudden expulsion while the mother is in the erect position, may prove injurious. Without denying that these may possibly occur now and again, it is certain that in the majority of cases over-rapid labor is not attended with any evil effects.

Precipitate labor may generally be traced to one of two conditions, or to a combination of both: excessive force and rapidity of the pains, or unusual laxity and want of resistance of the soft parts. The precise causes inducing these it is difficult to estimate. In some cases the former may depend on an undue amount of nervous excitability, and the latter on the constitutional state of the patient tending to relaxation of the tissues.

Whatever the cause, the extreme rapidity of labor is occasionally remarkable, and one strong pain may be sufficient to effect the expulsion of the child, with little or no preliminary warning. I have known a child to be expelled into the pan of a water-closet, the only previous indication of commencing labor being a slight griping pain, which led the mother to fancy that an action of the bowels was about to take place. More often there is what may be described as a storm of uterine contractions, one pain following the other with great intensity, until the fœtus is expelled. The natural effect of this is to produce a great amount of alarm or nervous excitement, which of itself forms one of the worst results of this class of labor. It is under such circumstances that temporary mania occurs, produced by the intensity of the suffering, under which the patient may commit acts her responsibility for which may fairly be open to question.

Little can be done in treating undue rapidity of labor. We can, to some extent, modify the intensity of the pains by urging the patient to refrain from voluntary efforts, and to open the glottis by crying out, so that the chest may no longer be a fixed point for muscular action. Opiates have been advised to control uterine action, but it is needless to point out that, in most cases, there is no time for them to take effect. Chloroform will often be found most valuable, from the rapidity with which it can be exhibited; and its power of diminishing uterine action, which forms one of its chief drawbacks in ordinary practice, will here prove of much service.

CHAPTER X.

LABOR OBSTRUCTED BY FAULTY CONDITION OF THE SOFT PARTS.

Rigidity of the Cervix.—One of the most frequent causes of delay in the first stage of labor is rigidity of the cervix uteri, which may depend on a variety of conditions. It is often produced by premature escape of the liquor amnii, in consequence of which the fluid wedge, which is nature's means of dilating the os, is destroyed, and the hard presenting part is consequently brought to bear directly upon the tissues of the cervix, which are thus unduly irritated, and thrown into a state of spasmodic contraction. At other times it may be due to constitutional peculiarities, among which there is none so common as a highly nervous and emotional temperament, which renders the patient peculiarly sensitive to her sufferings, and interferes with the harmonious action of the uterine fibres. The pains, in such cases, cause intense agony, are short and cramp-like in character, but have little or no effect in producing dilatation; the os often remaining for many hours without any appreciable alteration, its edges being thin and tightly stretched over the head. Less often, and this is generally met with in stout plethoric women, the edges of the os are thick and tough.

The *effects* of prolongation of labor from this cause will vary much under different circumstances. If the liquor amnii be prematurely evacuated, the presenting part presses directly upon the cervix, and the case is then practically the same as if the labor were in the second stage. Hence grave symptoms may soon develop themselves, and early interference may be imperatively demanded. If the membranes be unruptured, delay will be of comparatively little moment, and considerable time may elapse without serious detriment to either the mother or child.

The *treatment* will naturally vary much with the cause, and the state of the patient. In the majority of cases, especially if the membranes be still intact, patience and time are sufficient to overcome the obstacle; but it is often in the power of the accoucheur materially to aid dilatation by appropriate management. Sometimes nature overcomes the obstruction by lacerating the opposing structures, and cases are on record in which even a complete ring of the cervix has been torn off, and come away before the head.

Many remedies have been recommended for the purpose of facilitating dilatation, some of which are no doubt capable of acting beneficially. Amongst those most frequently resorted to was venesection, which was long a favorite, and with it was generally associated the administration of nauseating doses of tartar emetic. Both these acted by producing temporary depression, under which the resistance of the soft parts was lessened. They probably answered best in cases in which there was a rigid and tough cervix; and they might prove serviceable, even yet, in stout plethoric women of robust frame. Practically, however, they are now seldom, if ever, employed, and other and less debilitating remedies are preferred. The agent, *par excellence*, which is most serviceable is chloral, which is of special value in the more common cases in which rigidity is associated with spasmodic contraction of the muscular fibres of the cervix. Two to three doses of 15 grains, repeated at intervals of twenty minutes, are often of almost magical efficacy, the pains becoming steady and regular, and the os gradually relaxing sufficiently to allow the passage of the head. The inhalation of chloroform acts much in the same way, but on the whole less satisfactorily, its effects being often too great; while the peculiar value of the chloral is its influence in promoting relaxation of the tissues, without interfering with the strength of the pains.

Various *local means of treatment* may be also advantageously used. One of those most commonly employed is the warm bath, which is much used in France. It is of unquestionable value where there is much rigidity, and may be used either as an entire bath, or as a hip bath, in which the patient sits from twenty minutes to half an hour. The objection is the fuss and excitement it causes, and, for this reason, it is an expedient seldom resorted to in this country. A similar effect is produced, and much more easily, by a douche of tepid water upon the cervix. This can be very easily administered, the pipe of a Higginson's syringe being guided up to the cervix by the index finger of the right hand, and a stream of water projected against it for five or ten minutes. Smearing the os with extract of belladonna is advised by Continental authorities, but its effects are more than doubtful.

Artificial dilatation of the cervix by the finger has often been recommended, and has been the subject of much discussion, especially in the Edinburgh school, where it was formerly commonly employed. It is capable of being very useful, but it may also do much injury when roughly and injudiciously used. The class of cases in which it is most serviceable are those in which the liquor amnii has been long evacuated, and in which the head, covered by the tightly-stretched cervix, has descended low into the pelvic cavity. Under these circumstances, if the finger be passed gently within the os during a pain, and its margin pressed upwards and over the head, as it were, while the contraction lasts, the progress of the case may be materially facilitated. This manœuvre is somewhat similar to that which has been already spoken of, when the anterior lip of the cervix is caught between the head and the pubic bone, and, if properly performed, I believe it to be quite safe, and often of great value. It is not, however, well adapted for those cases in which the membranes are still intact, or in which the os remains undilated when the head is still high in the pelvis. When there is much delay under these conditions, and interference of some kind seems called for, the dilatation may be much assisted by the use of the caoutchouc dilators, described in the chapter on the induction of premature labor, which imitate nature's method of opening up the os, and also act as a direct stimulant to uterine contraction. But it should be remembered that it is precisely in such cases that delay is least prejudicial. If, however, the os be excessively long in opening, its dilatation may be safely and efficiently promoted by passing within it, and distending with water, one of the smaller-sized bags; and after this has been in position from ten to twenty minutes it may be removed, and a larger size substituted.

Every now and again we meet with cases in which the obstacle depends upon some organic changes in the cervix, the most common of which are cicatricial hardening from former lacerations; hypertrophic elongation of the cervix from disease antecedent to pregnancy; or even agglutination and closure of the os uteri. Cicatrices are generally the result of lacerations during former labors. They implicate a portion only of the cervix, which they render hard, rigid, and undilatable, while the remainder has its normal softness. They can readily be made out by the examining finger. A somewhat similar, but much more formidable, obstruction is occasionally met with in cases of old standing hypertrophic elongation of the cervix, which is generally associated with prolapse. In most cases of this kind the cervix becomes softened during pregnancy, so that dilatation occurs without any unusual difficulty. But this is not always the case. A good example is related by Mr. Roper, in the seventh volume of the "Obstetrical Transactions," in which such a cervix formed an almost insuperable obstacle to the passage of the child.

Carcinoma.—Another mechanical obstacle is carcinoma of the cervix uteri, which produces extensive thickening and induration of its tissues; and the numerous examples of this kind recorded prove that even advanced malignant disease of the uterus is no bar to conception.

Occlusion of the Os.—Agglutination of the margins of the os uteri is occasionally met with, and must, of course, have occurred after conception, which otherwise would have been impossible. This is generally the result of some inflammatory affection of the cervix during the early months of gestation; and I have known it recur in the same woman in two successive pregnancies. Usually it is not associated with any hardness or rigidity, but the entire cervix is stretched over the presenting part, and forms a smooth covering, in which the os may only exist as a small dimple, and may be very difficult to detect at all.

Treatment.—Any of these mechanical causes of rigidity may at first be treated in the same way as the more simple cases; and with patience, the use of chloral and chloroform, and of the fluid dilators, sufficient expansion to permit the passage of the head will often take place. But if these methods produce no effect, and symptoms of constitutional irritation are beginning to develop themselves, other and more radical means of overcoming the obstruction may be imperatively required.

Incision of the Cervix.—Under such circumstances incision of the cervix may be not only justifiable but essential, and it frequently answers extremely well. On the Continent it is resorted to much more frequently and earlier than in this country, and with the most beneficial results. The operation offers no difficulties. The simplest way of performing it is to guard the greater portion of the blade of a straight blunt-pointed bistoury by wrapping lint or adhesive plaster round it, leaving about half an inch of cutting edge towards its point. This is guided to the cervix, on the under surface of the index finger, and three or four notches are cut in the circumference of the os to about the depth of a quarter of an inch. Very generally, especially when the obstruction is only due to old cicatrices, the pains will now speedily effect complete expansion, which may be very advantageously aided by applying the hydrostatic dilators. When the obstruction is due to carcinomatous infiltration or inflammatory thickening, the case is much more complicated, and will painfully tax the resources of the accoucheur. Still, there can be no question that incisions should form a preliminary to any subsequent proceedings that may be necessary, as they are, at the worst, not likely to increase in the least the risks the patient has to run, and they may possibly avert more serious operations. In the case of malignant disease the risk of serious hemorrhage, from the great vascularity of the tissues, must not be forgotten, and, if necessary, means must be taken to check this by local styptics, such as perchloride of iron. If incision fail, and the state of the patient demands speedy delivery, it may be necessary to reduce the bulk of the child by perforation, or, in the worst cases of malignant infiltration, even to resort to the Cæsarean section.

Application of the Forceps within the Cervix.—Before performing craniotomy, when the os is sufficiently open to admit the blades, a cautious application of the forceps is quite justifiable. Steady and careful downward traction, combined with digital expansion, has often enabled a head to pass with safety through an os that has resisted all other means of dilatation, and the destruction of the child has thus been avoided. If, indeed, the os appear to be dilatable, this procedure may advantageously be adopted before incision; and, as a matter of fact, it is commonly practised in the Rotunda Hospital. An operation involving, beyond doubt, of itself some risk, and requiring considerable operative dexterity, would naturally not be lightly and inconsiderately undertaken. But when it is remembered that the alternative is the destruction of the child, the risk of exhaustion, and at least as great mechanical injury to the mother, its difficulty need not stand in the way of its adoption.

Treatment when Occlusion of the Os exists.—When the os is apparently obliterated, incision is the only resource. Before resorting to it, the patient should be placed under chloroform, and the entire lower segment of the uterus carefully explored. Possibly the aperture may be found high up, and out of reach of an ordinary examination, or we may detect a depression corresponding to its site. A small crucial incision may then be made at the site of the os, if this can be ascertained; if not, at the most prominent portion of the cervix. Very generally the pains will then suffice to complete expansion, which may be further aided by the fluid dilators.

Bands and Cicatrices in the Vagina.—Extreme rigidity of the vagina, or bands and cicatrices in or across its walls, the result of injuries in former labors, or of antecedent disease, occasionally obstruct the second stage. There is seldom any really formidable difficulty from this cause, since the obstruction almost always yields to the pressure of the presenting part. If there be any considerable extent of cicatrices in the vagina, artificial assistance may be required. If we should be aware of their existence during pregnancy, and find them to be sufficiently dense and extensive to be likely to interfere with delivery, an endeavor may be made to dilate them gradually by hydrostatic bags or bougies. If they be not detected until labor is in progress, we must be guided in our procedures by the pressure to which they are subjected. It may then be necessary to divide them with a knife, and to hasten the passage of the head by the forceps, so as to prevent contusion as much as possible. It is obviously impossible to lay down any positive rules for such rare contingencies, the treatment suitable for which must necessarily vary much with the individual peculiarities of the case.

Extreme rigidity of the perinæum is often dependent upon cicatricial hardening from injury in previous labors. This may greatly interfere with its dilatation; and if laceration seem inevitable, we may be quite justified in attempting to avert it by incision of the margins of the perinæum, on the principle of a clear cut being always preferable to a jagged tear.

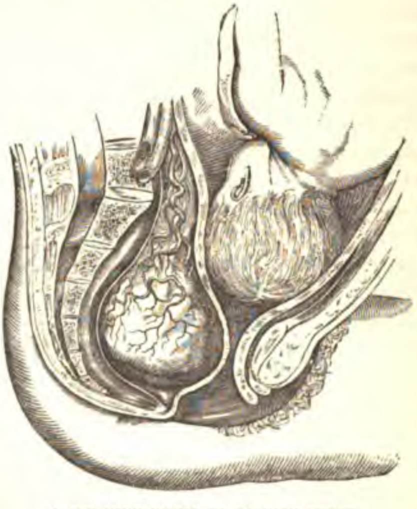
Labor complicated with Tumor.—Occasionally, we meet with very formidable obstacles from tumors connected with the maternal structures. These are most commonly either fibroid or ovarian, although others may be met with, such as malignant growths from the pelvic bones, exostoses, &c.

Fibroid Tumors of the Uterus.—Considering the frequency with which women suffer from fibroid tumors of the uterus, it is perhaps somewhat remarkable that they do not more often complicate delivery. Probably women so affected are not apt to conceive. Occasionally, however, cases of this kind cause much anxiety. Of course, the cases are most grave in which the tumors are so situated as to encroach upon the cavity of the pelvis and mechanically obstruct the passage of the child. Even those in which this does not occur are by no means free from danger, for interstitial and sub-peritoneal fibroids, situated in the upper parts of the uterus, and leaving the pelvic cavity quite unimplicated, may interfere with the action of the uterine fibres, prevent subsequent contraction, cause profuse post-partum hemorrhage, or even predispose to rupture of the uterine tissue. Hence every case in which the existence of uterine fibroids has been ascertained must be anxiously watched. The risk of hemorrhage is perhaps the greatest; for, if the tumors be at all large, efficient contraction of the uterus after the birth of the child must be more or less interfered with. It does not, however, necessarily ensue. I recently saw an interesting example of this in a patient, whose case was looked forward to with much anxiety, in consequence of the existence of several enormous fibroid masses projecting from the fundus and anterior surface of the body of the uterus, and whose labor was, nevertheless, typically normal in every way. Should hemorrhage occur after delivery, the injection of styptic solutions would probably be peculiarly valuable, since the ordinary means of promoting contraction are likely to fail.

It is when the fibroid growths implicate the lower uterine zone and the cervical region, that the greatest difficulties are likely to be met with. The practice then to be adopted must be regulated to a great extent by the nature of each individual case. If it be possible to push the tumor above the pelvic brim, out of the way of the presenting part, that, no doubt, is the best course to pursue, as not only clearing the passage in the most effectual way, but removing the tumor from the bruising to which it would otherwise be subjected when pressed between the head and the pelvic walls, which seems to be one of the greatest dangers of this complication. This manœuvre is sometimes possible in what seem to be the most unpromising circumstances. An interesting example of this is narrated by Mr. Spencer Wells,[1] who, called to perform the Cæsarean section, succeeded, although not without much difficulty, in pushing the obstructing mass above the brim, the child subsequently passing with ease.

Enucleation or Ablation.—Failing this, the possibility of enucleating the tumor, or, if that be not possible, of removing it piecemeal with the écraseur, should be carefully considered. On account of the loose attachments of these growths, and the facility with which they can be removed in this way in the non-pregnant state, the expedient seems certainly well worthy of a trial, if their site and attachments render it at all feasible. Interesting examples of the successful performance of this operation are recorded by Danyau and Braxton Hicks. Should it be found impracticable, the case must be managed in reference to the amount of obstruction; and the forceps, craniotomy, and even the Cæsarean section, may be necessary.

FIG. 116.



LABOR COMPLICATED BY OVARIAN TUMOR.

Tumors of the Ovary.—The next most common class of obstructing tumors are those of the ovary (Fig. 116), and it is apparently not the larger of these which are most apt to descend into the pelvic cavity.

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[1] Obstet. Trans., vol. ix. p. 73.

When the tumor is of any considerable size, its bulk is such that it cannot be contained in the true pelvis, and it rises into the abdominal cavity with the uterus. Hence the existence of the tumor that offers the most formidable obstacle to delivery is rarely suspected before labor sets in.

In order to estimate the results of the various methods of treatment, I have tabulated 57 cases.[1] In 13 labor was terminated by the natural powers alone; but of these 6 mothers, or nearly one-half, died. In favorable contrast with these we have the cases in which the size of the tumor was diminished by puncture. These are 9 in number, in all of which the mothers recovered—6 out of the 9 children being saved. The reason of the great mortality in the former cases is apparently the bruising to which the tumor, even when small enough to allow the child to be squeezed past it, is necessarily subjected. This is extremely apt to set up a fatal form of diffuse inflammation, the risk of which was long ago pointed out by Ashwell,[2] who draws a comparison between cases in which such tumors have been subjected to contusion and cases of strangulated hernia; and the cause of death in both is doubtless very similar. This danger is avoided when the tumor is punctured, so as to become flattened between the head and the pelvic walls. On this account, I think, it should be laid down as a rule that puncture should be performed in all cases of ovarian tumor engaged in front of the presenting part, even when it is of so small a size as not to preclude the possibility of delivery by the natural powers.

In 5 of the 57 cases it was found possible to return the tumor above the pelvic brim, and in these also the termination was very favorable, all the mothers recovering. Should puncture not succeed, and it may fail on account of the gelatinous and semi-solid nature of the contents of the cyst, it may be possible to dispose of the tumor in this way, even when it seems to be firmly wedged down in front of the presenting part, and to be hopelessly fixed in its unfavorable position.

Failing either of these resources, it may be necessary to resort to craniotomy, provided the size of the tumor precludes the possibility of delivery by forceps.

The question of the effect on labor of ovarian tumor which does not obstruct the pelvic canal is one of some interest, but there are not a sufficient number of cases recorded to throw much light on it. I am disposed to think that labor generally goes on favorably. What delay there is depends on the inefficient action of the accessory muscles engaged in parturition, on account of the extreme distension of the abdomen.

Vaginal Cystocele.—There are a few other conditions, connected with the maternal structures, which may impede delivery, but which are of comparatively rare occurrence. Amongst them is vaginal cystocele, consisting of a prolapse of the distended bladder in front of the presentation, where it forms a tense fluctuating pouch, which has been mistaken for an hydrocephalic head, or for the bag of membranes. This complication is only likely to arise when the bladder has been allowed to become unduly distended from want of attention to the voiding of urine during labor. The diagnosis should not offer any difficulty, for the finger will be able to pass behind, but not in front of, the swelling, and reach the presenting part; while the pain and tenesmus will further put the practitioner on his guard. The treatment consists in emptying the bladder; but there may be some difficulty in passing the catheter in consequence of the urethra being dragged out of its natural direction. A long elastic male catheter will almost always pass, if used with care and gentleness. Should it be found impossible to draw off the water, and this is said to have sometimes happened, the tense pouch might be punctured without danger by the fine needle of an aspirator trocar, and its contents withdrawn. When once the viscus is emptied, it can easily be pushed above the presenting part in the intervals between the pains.

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[1] Obstet. Trans., vol. ix.

[2] Guy's Hospital Reports, vol. ii.

Vesical Calculus.—In some few cases difficulties have arisen from the existence of a vesical calculus. Should this be pushed down in front of the head, it can readily be understood that the maternal structures would run the risk of being seriously bruised and injured. Should we make out the existence of a calculus—and, if the presence of one be suspected, the diagnosis could easily be made by means of a sound—an endeavor should be made to push it above the brim of the pelvis. If that be found to be impossible, no resource is left but its removal, either by crushing, or by rapid dilatation of the urethra, followed by extraction. Should we be aware of the existence of a calculus during pregnancy, its removal should certainly be undertaken before labor sets in.

Hernial protrusion in Douglas's space may sometimes give rise to anxiety from the pressure and contusion to which it is necessarily subjected. An endeavor must be made to replace it, and to moderate the straining efforts of the patient; and it may be even advisable to apply the forceps so as to relieve the mass from pressure as soon as possible. This complication, however, is of great rarity.

Scybalous masses in the intestine may be so hard and impacted as to form an obstruction. The necessity of attending to the state of the rectum has already been pointed out. Should it be found impossible to empty the bowel by large enemata, the mass must be mechanically broken down and removed by the scoop.

Œdema of the Vulva.—Excessive œdematous infiltration of the vulva may sometimes cause obstruction, and require diminution in size, which can be easily effected by numerous small punctures.

Hæmatic effusions into the cellular tissue of the vulva or vagina form a grave complication of labor. Such blood swellings are most usually met with in one or both labia, or under the vaginal wall; in the gravest forms, the blood may extend into the tissues for a considerable distance, as in the case recorded by Cazeaux, where it reached upwards as far as the umbilicus in front, and as far as the attachment of the diaphragm behind.

The conditions associated with pregnancy, the distension and engorgement to which the vessels are subjected, the interference with the return of the blood by the pressure of the head during labor, and the violent efforts of the patient, afford a ready explanation of the reason why a vessel may be predisposed to rupture and admit of the extravasation of blood.

The accident is, fortunately, far from a common one, although a sufficient number of cases are recorded to make us familiar with its symptoms and risks. The dangers attending such effusions would seem to be great, if the statistics given by those who have written on the subject are to be trusted. Thus, out of 124 cases collected by various French authors, 44 proved fatal. Dr. Fordyce Barker points out that, since the nature and appropriate treatment of the accident have been more thoroughly understood, the mortality has been much lessened; for out of 15 cases reported by Scanzoni only 1 died, and out of 22 cases he had himself seen 2 died, and all these 3 deaths were from puerperal fever, and not the direct result of the accident.[1]

The blood may be effused into any part of the pelvic cellular tissue, or into the labia. The accident most often happens during labor when the head is low down in the pelvis, not infrequently just as it is about to escape from the vulva. Hence the extravasation is more often met with low down in the vagina, and more frequently in one of the labia than in any other situation. I have met with a case where I had every reason to believe that an extravasation of blood had occurred within the tissues immediately surrounding the cervix. It is natural to suppose that a varicose condition of the veins about the vulva would predispose to the accident; but in most of the recorded examples this is not stated to have been the case. Still, if varicose veins exist to any marked degree, some anxiety on this point cannot but be felt.

The thrombus occasionally, though rarely, forms before delivery. Most commonly it first forms towards the end of labor, or even after the birth of the child. In the latter case it is probable that the laceration in the vessels occurred before the birth of the child, and that the pressure of the presenting part prevented the escape of any quantity of blood at the time.

The *symptoms* are not by any means characteristic. Pain of a tearing character, occasionally very intense, and extending to the back and down the thighs, is very generally associated with the formation of the thrombus. If a careful physical examination be made, the nature of the case can readily be detected. When the blood escapes into the labium, a firm, hard swelling is felt, which has even been mistaken for the fœtal head. If the effusion implicate the internal parts only, the diagnosis may not at first be so evident. But even then a little care should prevent any mistake, for the swelling may be felt in the vagina, and may even form an obstacle to the passage of the child. Cazeaux mentions cases in which it was so extensive as to compress the rectum and urethra, and even to prevent the exit of the lochia. In some cases the distension of the tissues is so great that they lacerate, and then hemorrhage, sometimes so profuse as directly to imperil the life of the patient, may occur. The bursting of the skin may take place some time subsequent to the formation of the thrombus. Constitutional symptoms, of course, will be in proportion to the amount of blood lost, either by extravasation, or externally, after the rupture of the superficial tissues. Occasionally they are considerable, and are the same as those which are familiar to us in connection with hemorrhage from any cause.

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[1] The Puerperal Diseases, p. 60.

The *terminations* of thrombus are either spontaneous absorption, which may occur if the amount of blood extravasated be small; or the tumor may burst, and then we have external hemorrhage; or it may suppurate, the contained coagula being discharged from the cavity of the cyst; and, finally, sloughing of the superficial tissues has occurred.

The *treatment* must naturally vary with the size of the thrombus, and the time at which it forms. If it be met with during labor, unless it be extremely small, it will be very apt to form an obstruction to the passage of the child. Under the circumstances, it is clearly advisable to terminate the labor as soon as possible, so as to remove the obstacle to the circulation in the vessels. For this purpose the forceps should be applied as soon as the head can be easily reached. If the tumor itself obstruct the passage of the head, or if it be of any considerable size, it will be necessary to incise it freely at its most prominent point and turn out the coagula, controlling the hemorrhage at once by filling the cavity with cotton wadding saturated in a solution of perchloride of iron, while at the same time digital compression with the tips of the fingers is kept up. By this means pressure is applied directly to the bleeding point, and the hemorrhage can be controlled without difficulty. This is all the more necessary if spontaneous rupture have taken place, for then the loss of blood is often profuse, and it is of the utmost importance to reach the site of the hemorrhage as nearly as possible.

If the thrombus be not so large as to obstruct delivery, or if it be not detected until after the birth of the child, the question arises whether the case should not be left alone, in the hope that nature may effect absorption, as in most cases of pelvic hæmatocele. This expectant treatment is advised by Cazeaux, and it seems to be the most rational plan we can adopt. True, it may take a longer time for the patient to convalesce completely than if the coagula were removed at once and the hemorrhage restrained by pressure on the bleeding point; but this disadvantage is more than counterbalanced by the absence of risk from hemorrhage, and of septicæmia from the suppuration that must necessarily follow. Softening and suppuration may, in many cases, occur in a few days, necessitating operation, but the vessels will then be probably occluded, and the risk of hemorrhage much lessened. Dr. Barker, however, holds the opposite opinion, and thinks that the proper plan is to open the thrombus early, controlling the hemorrhage in the manner already indicated, unless the thrombus is situated high in the vaginal canal.

Whenever the cavity of a thrombus has been opened, either by incision, or by spontaneous softening at some time subsequent to its formation, it must not be forgotten that there is considerable risk from septic absorption. To avoid this, care must be taken to use antiseptic dressings freely, such as the glycerine of carbolic acid applied directly to the part, and frequent vaginal injections of diluted Condy's fluid. Barker lays special stress on the importance of not removing prematurely the coagula formed by the styptic applications, for fear of secondary hemorrhage, but of allowing them to come away spontaneously.

CHAPTER XI.

DIFFICULT LABOR DEPENDING ON SOME UNUSUAL CONDITION OF THE FŒTUS.

Plural Births.—The subject of multiple pregnancy in general having already been fully considered, we have now only to discuss its practical bearing as regards labor. Fortunately, the existence of twins rarely gives rise to any serious difficulty. In the large proportion of cases the presence of a second fœtus is not suspected until the birth of the first is completed, when the nature of the case is at once apparent from the fact of the uterus remaining as large, or nearly as large, as it was before.

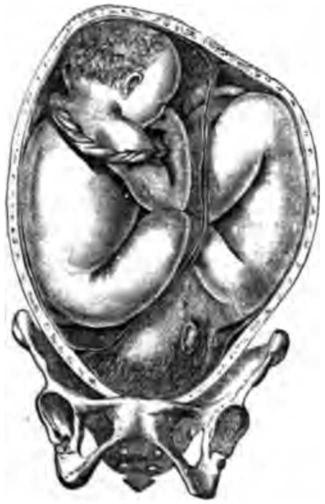
There may possibly be some delay in the birth of the first child, inasmuch as the extreme distension of the uterus may interfere with its thoroughly efficient action; while, in addition, the uterine pressure is not directly conveyed to the ovum as in single births, but indirectly through the amniotic sac of the second child (Fig. 117). Such delay is especially apt to arise when the first child presents by the breech, for, even if the body be expelled spontaneously, difficulty is likely to occur with the head, since the uterus does not contract upon it as is ordinarily the case. Hence the intervention of the accoucheur to save the life of the child, by the extraction of the head, will be almost a matter of necessity.

In the majority of cases, after the birth of the first child there is a temporary lull in the pains, which soon recommence, generally in from ten to twenty minutes, and the second child is rapidly expelled; for, on account of the full dilatation of the soft parts, there is no obstacle to its delivery. Sometimes there is a considerable interval before pains recur, and instances are recorded in which even several days have elapsed between the births of the two children.

In most cases the management of twin does not differ from that of ordinary labor. As soon as we are certain of the existence of a second fœtus, we should inform the bystanders, but not necessarily the mother, to whom the news might prove an unpleasant and even dangerous shock. Then, having taken care to tie the cord of the first child for fear of vascular communication between the placentæ, our duty is to wait for the recurrence of pains. If these come on rapidly, and the presentation of the second fœtus be normal, its birth is managed in the usual way.

If there be any unusual delay, we have to consider the proper course to pursue, and on this the opinions of authorities differ greatly. Some advise a delay of several hours, and even more, if pains do not recur spontaneously; while others, Murphy for example, recommend that the second child should be delivered at once. Either extreme of practice is probably wrong, and the safest and best course is, doubtless, the medium one. The special point to bear in mind is that in multiple pregnancy, on account of the extreme distension of the uterus, there is a tendency to inertia, and consequently to post-partum hemorrhage; and that therefore it is better that the birth of the second child should be delayed, even for a considerable time, rather than that the patient should run the risk attending an empty and uncontracted uterus. If, however, uterine action be present, there is an obvious advantage in the delivery of the second child before the dilatation of the passages passes off.

FIG. 117.



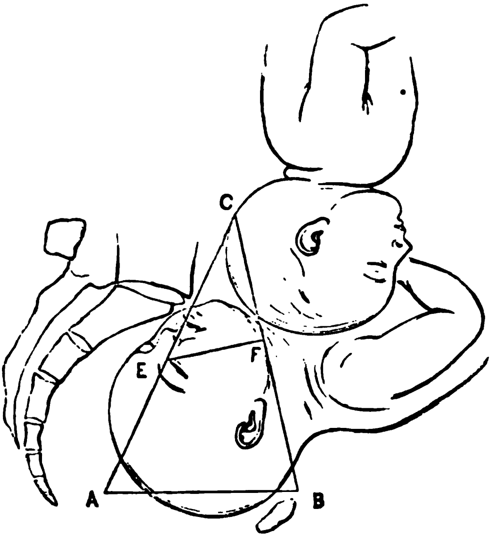
TWIN PREGNANCY, BREECH AND HEAD PRESENTING.

The best plan would seem to be, if, after waiting a quarter of an hour, labor pains do not recur, to try and induce them by uterine friction and pressure, and by the administration of a dose of ergot, to which, as there can be no obstacle to the rapid birth of the second child, there can be now no objection. The membranes of the second child should always be ruptured at once, if easily within reach, as one of the speediest means of inducing contraction. If no progress be made, and speedy delivery be indicated—a necessity which may arise either from the exhausted state of the patient, the presence of hemorrhage, extremely feeble pulsations of the fœtal heart (showing that the life of the second child is endangered), or malpresentation of the second fœtus—turning is probably the readiest and safest expedient. Under such circumstances the operation is performed with great ease, since the passages are all amply dilated. After bringing down the feet, the birth of the body should be slowly effected, with the view of ensuring as complete subsequent contraction as possible. If the head has descended into the pelvis, of course turning is impossible, and the forceps must be applied.

Occasionally very serious difficulties arise from parts of both fœtuses presenting simultaneously, and either thus impeding the entrance of either child into the pelvis, or getting locked together, so as to render delivery impossible without artificial aid. Such difficulties are not apt to arise in the more ordinary cases, in which each child has its own bag of membranes, since then the fœtuses are kept entirely separate; but in those in which the twins are contained in a common amniotic cavity, or in which both sacs have burst simultaneously. They are very puzzling to the obstetrician, and it may be far from easy to discover the cause of the obstruction. Nor is it possible to lay down any positive rules for their management, which must be governed, to a considerable extent, by the circumstances of each individual case.

Sometimes both heads present simultaneously at the brim, and then neither can enter unless they be unusually small or the pelvis very capacious, when both may descend; or rather the first head may descend low into the pelvic cavity, and then the second head enters the brim, and gets jammed against the thorax of the first child (Fig. 118). Reiman[1] relates a curious example of this, in which he delivered the first head with the forceps, but found the body would not follow, and, on examination, a second head was found in the pelvis. He then applied the forceps to the second head; the body of the first child was then born, and afterwards that of the second. Such a mechanism must clearly have been impossible unless the pelvis had been extremely large.

FIG. 118.



SHOWS HEAD-LOCKING, BOTH CHILDREN PRESENTING HEAD FIRST.

Both Heads presenting simultaneously.—Whenever both heads are felt at the brim, it will generally be found possible to get one out of the way by appropriate manipulation, one hand being passed into the vagina, the other aiding its action from without. Then the forceps may be applied to the other head, so as to engage it at once in the pelvic cavity. If both have actually passed into the pelvis, as in the case just alluded to, the difficulty will be much greater. It will generally be easier to push up the second head, while the lower is drawn out by the forceps, than to deliver the second, leaving the first *in situ.*

Foot or Hand with Head.—In other cases a foot or a hand may descend along with the head, and even the four feet may present simultaneously. The rule in the former case is to push the part descending with the head out of the way, and in the latter to disengage one child as soon as possible. Great care is necessary, or we might possibly bring down the limbs of separate children.

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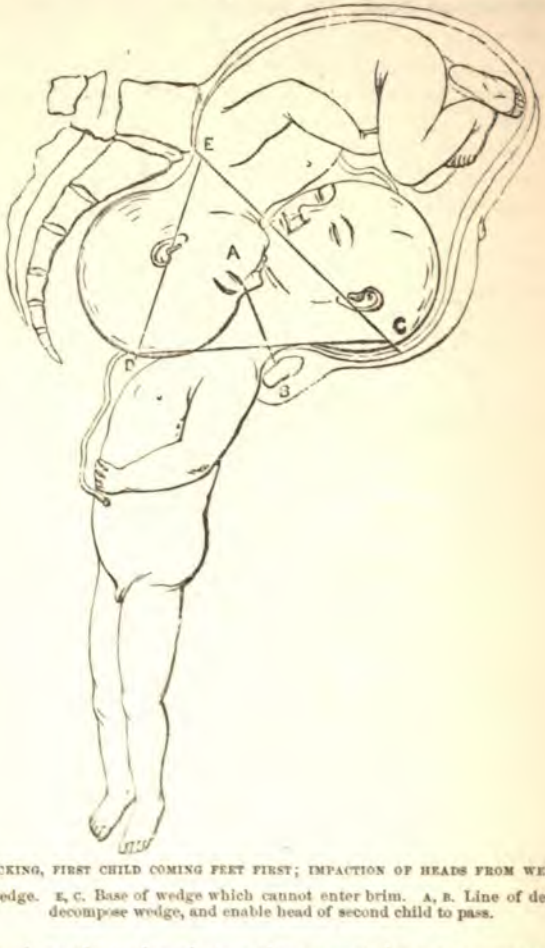
[1] Arch. f. Gynak., 1871.

The most common kind of difficulty is, when the first child presents by the breech, and is delivered as far as the head, which is then found to be locked with the head of the second child, which has descended into the pelvic cavity (Fig. 119).

FIG. 119.



SHOWS HEAD-LOCKING, FIRST CHILD COMING FEET FIRST; IMPACTION OF HEADS FROM WEDGING IN BRIM.

D. Apex of wedge. E, C. Base of wedge which cannot enter brim. A, B. Line of decapitation to decompose wedge, and enable head of second child to pass.

Here it is clear that the obstruction must be very great, and, unless the children are extremely small, insuperable. The first endeavor should be to disentangle the heads; this is sometimes feasible if the second be not deeply engaged in the pelvis, and the hand be passed up so as to push it out of the way. This will but rarely succeed; then it may be possible to apply the forceps to the second head and drag it past the body of the first child; but generally the sacrifice of one of the children is essential. As the body of the first child must have been born for some time, it is probable that the pressure to which it has been subjected will have already imperilled, if it have not destroyed, its life, and therefore the plan usually recommended is to decapitate. This can easily be done with scissors or a wire écraseur, after which the second child is expelled without difficulty, leaving the head of the first in utero to be subsequently dealt with. Or the head which is lowest may be perforated behind the right ear or through the mouth, and subsequently crushed with the cephalotribe.

Another mode of managing these cases is, to perforate the upper head, and draw it past the lower with the cephalotribe or craniotomy forceps. This plan has the disadvantage of probably sacrificing both children, since the first child can hardly survive the pressure and delay, whereas the former gives the second child a fair chance of being born alive.

Conjoined Twins.—In connection with the subject of twin labor we may consider those rare cases in which the bodies of the fœtuses are partially fused together. The mechanism and management of delivery in cases of double monstrosity have attracted comparatively little attention, no doubt because authors have considered them matters of curiosity merely, rather than of practical importance.

The frequent occurrence of such monstrosities in our museums, and the numerous cases scattered through our periodical literature, are sufficient to show that they are not so very rare as we might be inclined to imagine; and, as they are likely to give rise to formidable difficulties in delivery, it cannot be unimportant to have a clear idea of the usual course taken by nature in effecting such births, with the view of enabling us to assist in the most satisfactory manner should a similar case come under our observation.

Unfortunately, the authors who have placed on record the birth of double monsters have generally occupied themselves more with a description of the structural peculiarities of the fœtuses than with the mechanism of their delivery; so that, although the cases to be met with in medical literature are very numerous, comparatively few of them are of real value from an obstetric point of view. Still, I have been able to collect the details of a considerable number in which the history[1] of the labor is more or less accurately described; and doubtless a more extensive research would increase the list.

For obstetric purposes we may confine our attention to four principal varieties of double monstrosity, which are met with far more frequently than any others. These are:—

A. Two nearly separate bodies united in front, to a varying extent, by the thorax or abdomen.

B. Two nearly separate bodies united back to back by the sacrum and lower part of the spinal column.

C. Dicephalous monsters, the bodies being single below, but the heads separate.

D. The bodies separate below, but the heads fixed or partially united.

This classification by no means includes all the varieties of monsters that we may meet with. It does, however, include all that are likely to give rise to much difficulty in delivery; and all the cases I have collected may be placed under one of these divisions.

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[1] Obstet. Trans., vol. viii.

The first point that strikes us in looking over the history of these deliveries is the frequency with which they have been terminated by the natural powers alone, without any assistance on the part of the accoucheur. Thus, out of the 31 cases no less than 20 were delivered naturally, and apparently without much trouble. Nothing can better show the wonderful resources of nature in overcoming difficulties of a very formidable kind.

It is pretty generally assumed by authors that the children are necessarily premature, and, therefore, of small size, and that delivery before the full term is rather the rule than the exception. Dugés states that the children are often dead, and that putrefaction has taken place, which facilitates their expulsion. Both these assumptions seem to me to have been made without sufficient authority, and not to be borne out by the recorded facts. In only 1 of the 31 cases is it mentioned that the children were premature; nor is there any sufficient reason that I can see why labor should commence before the full term of gestation.

Class A.—By far the greatest number are included in the first class—that in which the bodies are nearly separate, but united by some part of the thorax or abdomen. This is the division which includes the celebrated Siamese Twins, an account of whose birth, I may observe, I have not been able to discover. Out of the 31 cases, 19 come under this heading. The details of the labor are briefly as follows:—1 died undelivered; 8 were terminated by the natural powers, in 3 of which the feet and in 3 the head presented; in 2 the presentation is doubtful; 6 were delivered by turning, or by traction on the lower extremities; 4 were delivered instrumentally.

The details of the cases in which the feet presented, or in which turning was performed, clearly show that footling presentation is by far the most favorable, and it is fortunate the feet often present naturally. The inference, of course, is that version should be resorted to whenever any other presentation is met with in cases of double monstrosity of this type; but, unfortunately, this rule could rarely be carried into execution, since we possess no means of diagnosing the junction of the fœtuses at a sufficiently early stage of labor to admit of turning being performed. It is only under exceptionally favorable circumstances that this can be done; as, for example, in a case recorded by Molas,[1] in which both heads presented, but neither would enter the brim of the pelvis.

The great difficulty must of course be in the delivery of the heads; for in all the recorded cases, with one exception, the bodies have passed through the pelvis parallel to each other with comparative ease until the necks have appeared, and then, as a rule, they could be brought no farther. It is clear that the remainder of the fœtuses could no longer pass simultaneously; and, were direct traction continued, the heads would be inextricably fixed above the brim. In accordance with the direction of the pelvic axes the posterior head must first engage in the inlet; and in order to effect this it will be necessary to carry the bodies of the children well over the abdomen of the mother. This seems to be a point of primary importance. It would also be advisable to see that the bodies are made to pass through the pelvis with their backs in the oblique diameter. By this means more space is gained than if the backs were placed antero-posteriorly; while at the same time there is less chance of the heads hitching against the promontory of the sacrum and symphysis pubis, which otherwise would be very apt to occur.

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[1] Mém. de l'Académie, vol. i.

When the head presents, and the labor is terminated by the natural powers, delivery seems to be accomplished in one of two ways.

In the first and more common, the head and shoulders of one child are born, its breech and legs being subsequently pushed through the pelvis by a process similar to that of spontaneous evolution; and afterwards the second child probably passes footling without much difficulty.

Barkow relates a case in which *both* heads were delivered by the forceps, the bodies subsequently passing simultaneously. Two similar instances are recorded in the third and sixth volumes of the "Obstetrical Transactions." When delivery takes place in this manner, the head of the second child must fit into the cavity formed by the neck of the first, and the pelvis must necessarily be sufficiently roomy to admit of the expulsion of the head of the second child, while its cavity is diminished in size by the presence of the neck and shoulders of the first. Either of these processes must obviously require exceptionally favorable conditions as regards the size of the child and the pelvis; and the difficulty in the way of delivery must be much greater than when the lower extremities present. Therefore, I think the rule should be laid down that, when the nature of the case is made out (and for the purpose of accurate diagnosis a complete examination under anæsthesia should be practised), turning should be performed, and the feet brought down.

In the event of its being found impossible to effect delivery after a considerable portion of the bodies is born, no resource remains but the mutilation of the body of one child, so as to admit of the passage of the other. This was found necessary in one case in which the children presented by the feet, and were born as far as the thorax, but could get no farther. The body of the anterior child was removed by a circular incision as far as it had been expelled, which allowed the remaining portion, consisting of the head and shoulders, to re-enter the uterus; after this the posterior child was easily extracted, and the mutilated fœtus followed without difficulty.

In *Class B*, in which the children are united back to back, 3 cases are recorded, all of which were delivered by the natural powers. One of these is the case of Judith and Hélène, the celebrated Hungarian twins, who lived to the age of twenty-three. Hélène was born as far as the umbilicus, and, after the lapse of three hours, her breech and legs descended. Judith was expelled immediately afterwards, her feet descending first. Exactly the same process occurred in a case described by M. Norman, the children being also born alive, and dying on the ninth day.

It is probable that labor is easier in this class of double monsters than in the former, because the children are so joined that there is no necessity for the bodies to be parallel to each other during birth when the head presents, and after the birth of the head and shoulders of the first child its breech and lower extremities are evidently pushed down and expelled by a process of spontaneous evolution. If the feet originally presented, the mechanism of delivery and the rules to be followed would be the same as in class A; but the difficulty would probably be greater, since the juncture is not so flexible, and a more complete parallelism of the bodies would be necessary during extraction.

In *Class C*, that of the dicephalous monsters, I have found the description of the birth of 7 cases, 2 of which were terminated by the natural powers. Here again the process of evolution was the main agent in delivery; one head being born and becoming fixed under the arch of the pubes, the body being subsequently pushed past it, the second head following without difficulty. This process failing, the proper course is clearly to decapitate the first-born head, and then bring down the feet of the child, when delivery can be accomplished with ease. This was the course adopted in 2 out of the 7 cases; and it may be done with the less hesitation since, from their structural peculiarities, it is extremely improbable that monsters of this kind should survive. If the feet presented, the case may be managed in the same manner as in class A.

Class D.—Monstrosities of class D, in which the heads are united, the bodies being distinct, appear to be the most uncommon of all; and I can find the description of delivery in only 2 cases. One of these gave rise to great difficulty; the labor in the other was easy. We should scarcely anticipate much difficulty in the birth of monsters of this type; for, if the head presented and would not pass, we should naturally perform craniotomy; and if the bodies came first, the delivery of the monstrous head could readily be accomplished by perforation.

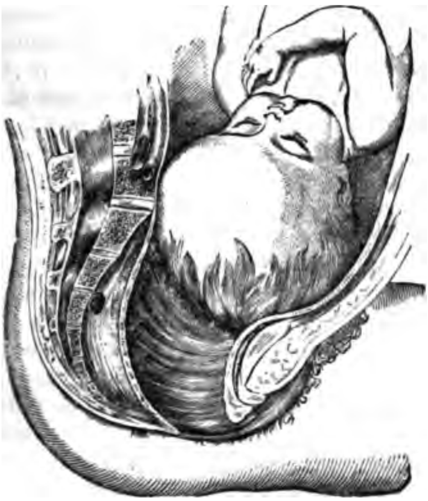
The *result to the mothers* in all these cases seems to have been very favorable. There is only one in which the death of the mother is recorded; and although in many the result is not mentioned, we may fairly assume that recovery took place.

Among difficulties in labor, some of the most important are due to morbid conditions of the fœtus itself.

Intra-uterine Hydrocephalus.—Of these the most common, as well as the most serious, is caused by intra-uterine hydrocephalus (giving rise to a collection of watery fluid within the cranium), by which the dimensions of the child's head are enormously increased, and the due relations between it and the pelvic cavity entirely destroyed (Fig. 120).

Fortunately, this disease is of comparatively rare occurrence, for it is one of great gravity both as regards the mother and child. As regards the mother, the serious character of the complication is proved by the statistics of Dr. Keiller, of Edinburgh, who found that out of 74 cases no less than 16 were accompanied by rupture of the uterus. The reason of the danger to which the mother is subjected is obvious. In some few cases, indeed, the head is so compressible that, provided the amount of contained fluid be small, it may be sufficiently diminished in size, by the moulding to which it is subjected, to admit of its being squeezed through the pelvis. In the majority of cases, however, the size of the head is too great for this to occur. The uterus therefore exhausts itself, and may even rupture, in the vain endeavor to overcome the obstacle; while the large and distended head presses firmly on the cervix, or on the pelvic tissues, if the os be dilated, and all the evil effects of prolonged compression are apt to follow.

FIG. 120.



LABOR IMPEDED BY HYDROCEPHALUS.

The diagnosis of intra-uterine hydrocephalus is by no means so easy as the description in obstetric works would lead us to believe. It is true that the head is much larger and more rounded in its contour than the healthy fœtal cranium, and also that the sutures and fontanelles are more wide, and admit occasionally of fluctuation being perceived through them. Still, it is to be remembered that the head is always arrested above the brim, where it is consequently high up and difficult to reach, and where these peculiarities are made out with much difficulty. As a matter of fact, the true nature of the case is comparatively rarely discovered before delivery: thus, Chaussier[1] found that in more than one-half of the cases he collected an erronous diagnosis had been made.

Method of Diagnosis.—Whenever we meet with a case in which either the history of previous labor, or a careful examination, convinces us that there is no obstacle due to pelvic deformity, in which the pains are strong and forcing, but in which the head persistently refuses to engage in the brim, we may fairly surmise the existence of hydrocephalus. Nothing, however, short of a careful examination under anæsthesia, the whole hand being passed into the vagina so as to explore the presenting part thoroughly, will enable us to be quite sure of the existence of this complication. Under these circumstances such a complete examination is not only justified, but imperative; and, when it has been made, the difficulties of diagnosis are lessened, for then we may readily make out the large round mass, softer and more compressible than the healthy head, the widely separated sutures, and the fluctuating fontanelles.

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[1] Gazette Médicale, 1864.

In a considerable proportion of cases—as many, it is said, as 1 out of 5—the fœtus presents by the breech. The diagnosis is then still more difficult; for the labor progresses easily until the shoulders are born, when the head is completely arrested, and refuses to pass with any amount of traction that is brought to bear on it. Even the most careful examination may not now enable us to make out the cause of the delay, for the finger will impinge on the comparatively firm base of the skull, and may be unable to reach the distended portion of the cranium. At this time abdominal palpation might throw some light on the case, for the uterus being tightly contracted round the head, we might be able to make out its unusual dimensions. The wasted and shrivelled appearance of the child's body, which so often accompanies hydrocephalus, would also arouse suspicion as to the cause of delay. On the whole, such cases may be fairly assumed to be less dangerous to the mother than when the head presents; for in the latter the soft parts are apt to be subjected to prolonged pressure and contusion, while in the former delay does not commence until after the shoulders are born, and then the character of the obstacle would be sooner discovered, and appropriate means earlier taken to overcome it.

The *treatment* is simple, and consists in tapping the head, so as to allow the cranial bones to collapse. There is the less objection to this course, since the disease almost necessarily precludes the hope of the child's surviving. The aspirator would draw off the fluid effectually, and would at least give the child a chance of surviving; and, under certain circumstances, the birth of a child, who lives for a short time only, may be of extreme legal importance. More generally the perforator will be used, and, as soon as it has penetrated, a gush of fluid will at once verify the diagnosis. Schroeder recommends that, after perforation, turning should be performed, on account of the difficulty with which the flaccid head is propelled through the pelvis. This seems a very unnecessary complication of an already sufficiently troublesome case. As a rule, when once the fluid has been evacuated, the pains being strong, as they generally are, no delay need be apprehended. Should the head not come down, the blades of the cephalotribe may be applied, which take a firmer grasp than the forceps, and enable the head to be crushed to a very small size and readily withdrawn.

When the breech presents, the head must be perforated through the occipital bone; and generally this may be accomplished behind the ear without much difficulty. It has been said that opening the vertebral canal might allow the intra-cranial fluid to escape; but I am not aware that the suggestion has ever been carried into practice.

Other forms of dropsical effusions may give rise to some difficulty, but by no means so serious. In a few rare cases the thorax has been so distended with fluid as to obstruct the passage of the child. Ascites is somewhat more common; and occasionally the child's bladder has been so enormously distended with urine as to simulate an ascitic abdomen and prevent the birth of the body. The existence of any of these conditions is easily ascertained; for the head or breech, whichever happens to present, is delivered without difficulty, and then the rest of the body is arrested. This will naturally cause the practitioner to make a careful exploration, when the cause of the delay will be detected.

The treatment consists in the evacuation of the fluid by puncture. In the case of ascites, this should always be done, if possible, by a fine trocar or aspirator, so as not to injure the child. This is all the more important since it is impossible to distinguish distended bladder from ascites, and an opening of any size into that viscus might prove fatal, whereas aspiration would do little or no harm, and prove quite as efficacious.

Certain fœtal tumors may occasion dystocia, such as malignant growths, or tumors of the kidney, liver, or spleen. Cases of this kind are recorded in most obstetric works. Hydro-encephalocele, or hydrorachitis, depending on defective formation of the cranial or spinal bones, with the formation of a large protruding bag of fluid, is not very rare. The diagnosis of all such cases must necessarily be somewhat obscure, nor is it possible to lay down any definite rules for their management, which must vary according to the particular exigencies. The tumors are rarely of sufficient size to prove very formidable obstacles to delivery, and many of them are very compressible. This is especially the case with spina bifida and similar cystic growths. Puncture, and, in the more solid growths of the abdomen or thorax, evisceration, may be required.

Other deformities, such as the anencephalous fœtus, or defective development of the thorax or abdominal parietes with protrusion of the viscera, are not likely to cause any difficulty; but they may much embarrass the diagnosis by the strange and unusual presentation that is felt. If, in any case of doubt, a full and careful examination be undertaken, introducing the whole hand if necessary, no serious mistake is likely to be made.

In addition to dystocia from morbid condition of the fœtus, it is admitted that difficulties may arise from its undue development, and especially from excessive size and advanced ossification of the skull. This last is especially likely to cause delay. Even the slight difference in size between the male and female head was found by Simpson to have an appreciable effect in increasing the difficulty of labor, when the statistics of a large number of cases were taken into account; for he proved beyond doubt that the difficulties and casualties of labor occurred in decidedly larger proportion in male than in female births. Other circumstances besides sex have an important effect on the size of the child. Thus, Duncan and Hecker have shown that it increases in proportion to the age of the mother and the frequency of the labors; while the size of the parents has no doubt also an important bearing on the subject.

Although these influences modify the results of labor *en masse*, they have little or no practical bearing on any particular case, since it is impossible to estimate either the size of the head, or the degree of its ossification, until labor is advanced.

When labor is actually retarded by undue ossification or large size of the head, the case must be treated on the same general principles which guide us when the want of proportion is caused by pelvic contraction. Hence, if delay arise, which the natural powers are insufficient to overcome, it will seldom happen that the disproportion is too great for the forceps to overcome. If we fail to deliver by them, no resource is left but the lessening of the bulk of the head by perforation.

Large size of the body of the child is still more rarely a cause of difficulty, for, if the head be born, the compressible trunk will almost always follow. Still, a few authentic cases are on record in which it was found impossible to extract the fœtus on account of the unusual bulk of its shoulders and thorax. Should the body remain firmly impacted after the birth of the head, it is easy to assist its birth by traction on the axillæ, by gently aiding the rotation of the shoulders into the antero-posterior diameter of the pelvic cavity, and, if necessary, by extracting the arms, so as to lessen the bulk of the part of the body contained in the pelvis. Hicks relates a case in which evisceration was required for no other apparent reason than the enormous size of the body. The necessity for any such extreme measure must, of course, be of the greatest possible rarity; and it is quite exceptional for difficulty from this source to be beyond the powers of nature to overcome.

CHAPTER XII.

DEFORMITIES OF THE PELVIS.

DEFORMITIES of the pelvis form one of the most important subjects of obstetric study, for from them arise some of the gravest difficulties and dangers connected with parturition. A knowledge, therefore, of their causes and effects, and of the best mode of detecting them, either during or before labor, is of paramount necessity; but the subject is far from easy, and it has been rendered more difficult than it need be, from over-anxiety on the part of obstetricians to force all varieties of pelvic deformities within the limits of their favorite classification.

Many attempts in this direction have been made, some of which are based on the causes on which the deformities depend, others on the particular kind of deformity produced. The changes of form, however, are so various and irregular, and similar, or apparently similar, causes so constantly produce different effects, that all such endeavors have been more or less unsuccessful. For example, we find that rickets (of all causes of pelvic deformity the most important) generally produces a narrowing of the conjugate diameter of the brim; while the analogous disease, osteo-malacia, occurring in adult life, generally produces contraction of the transverse diameter, with approximation of the pubic bones, and relative or actual elongation of the conjugate diameter. We might, therefore, be tempted to classify the results of these two diseases under separate heads, did we not find that, when rickets affects children who are running about, and subject to mechanical influences similar to those acting upon patients suffering from osteo-malacia, a form of pelvis is produced hardly distinguishable from that met with in the latter disease.

On the whole, therefore, the most simple, as well as the most scientific, classification is that which takes as its basis the particular seat and nature of the deformity. Let us first glance at the most common causes.

The key to the particular shape assumed by a deformed pelvis will be found in a knowledge of the circumstances which lead to its regular development and normal shape in a state of health. The changes produced may, almost invariably, be traced to the action of the same causes which produce a normal pelvis, but which, under certain diseased conditions of the bones or articulations, induce a more or less serious alteration in form. These have been already described in discussing the normal anatomy of the pelvis, and it will be remembered that they are chiefly the weight of the body, transmitted to the iliac bones through the sacro-iliac joints, and counter-pressure on these, acting through the acetabula. Sometimes they act in excess on bones which are healthy, but possibly smaller than usual, and the result may be the formation of certain abnormalities in the size of the various pelvic diameters. At other times they operate on bones which are softened and altered in texture by disease, and which, therefore, yield to the pressure far more than healthy bones.

The two diseases which chiefly operate in causing deformity are rickets and osteo-malacia. Into the essential nature and symptomatology of these complaints it would be out of place to enter here; it may suffice to remind the reader that they are believed to be pathologically similar diseases, with the important practical distinction that the former occurs in early life, before the bones are completely ossified, and that the latter is a disease of adults, producing softening in bones that have been hardened and developed. This difference affords a ready explanation of the generally resulting varieties of pelvic deformity.

Rachitis commences very early in life, sometimes, it is believed, even in utero. It rarely produces softening of the entire bones, and only in cases of very great severity of those parts of the bones that have been already ossified. The effects of the disease are principally apparent in the cartilaginous portions of the bones, in which osseous deposit has not yet taken place. The bones, therefore, are not subject to uniform change; and this fact has an important influence in determining their shape. Rickety children also have imperfect muscular development; they do not run about in the same way as other children, they are often continuously in the recumbent or sitting postures, and thus the weight of the trunk is brought to bear, more than in a state of health, on the softened bones. For the same reason, counter-pressure through the acetabula is absent or comparatively slight. When, however, the disease occurs for the first time in children who are able to run about, the latter comes into operation, and modifies the amount and nature of the deformity. It is to be observed that in rickety children the bones are not only altered in form from pressure, but are also imperfectly developed, and this, in itself, materially modifies the deformity. When ossific matter is deposited, the bones become hard and cease to bend under external influences, but retain forever the altered shape they have assumed.

In *osteo-malacia*, on the contrary, the already hardened bones become softened uniformly through all their textures, and thus the changes which are impressed upon them are much more regular, and more easily predicated. It is, however, an infinitely less common cause of pelvic deformity than rickets, as is evidenced by the fact that in the Paris Maternity, in a period of sixteen years, 402 cases of deformity due to rickets occurred to 1 due to osteo-malacia.[1]

The frequency of both diseases varies greatly in different countries, and under varying circumstances. Rickets is much more common amongst the poor of large cities, whose children are ill fed, badly clothed, kept in a vitiated atmosphere, and subjected to unfavorable hygienic conditions of all kinds. Deformities are, therefore, more common in them than in the more healthy children of the upper classes or of the rural population. The frequency of osteo-malacia is also found to be very different in certain places than in others. Thus, the higher degrees of deformity, necessitating the Cæsarean section, or craniotomy, are in this country of extreme rarity; while in certain districts on the Continent they seem to be so frequent that these ultimate resources of the obstetric art have to be constantly employed.

In another class of cases the ordinary shape is modified by weight and counter-pressure operating on a pelvis in which one or more of the articulations is ossified. In this way we have produced the *obliquely ovate* pelvis of Naegele, or the still more uncommon *transversely contracted* pelvis of Robert.

A certain number of deformed pelves cannot be referred to a modification of the ordinary developmental changes of the bones. Amongst these are the deformities resulting from spondylolithesis, or downward dislocation of the lower lumbar vertebræ; from displacements of the sacrum, produced by curvatures of the spinal column; or from diseases of the pelvic bones themselves, such as tumors, malignant growths, and the like.

The first class of deformed pelves to be considered is that in which the diameters are altered from the usual standard, without any definite distortion of the bones; and such are often mere congenital variations in size, for which no definite explanation can be given. Of this class is the pelvis which is equally enlarged in all its diameters (*pelvis equalibeter justo major*), which is of no obstetric consequence, except inasmuch as it may lead to precipitate labor, and is not likely to be diagnosed during life.

The corresponding diminution of all the pelvic diameters (*pelvis equalibeter justo minor*) may be met with in women who are apparently well formed in every respect, and whose external conformation and previous history give no indication of the abnormality. Sometimes the diminution amounts to half an inch or more; and it can readily be understood that such a lessening in the capacity of the pelvis would give rise to serious difficulty in labor. Thus, in 3 cases recorded by Naegele a fatal result followed; in 2 after difficult instrumental delivery, and in the third after rupture of the uterus. The equally lessened pelvis, however, is of great rarity. An unusually small pelvis may be met with in connection with general small size, as in dwarfs. It does not necessarily follow, because a woman is a dwarf, that the pelvis is too small for parturition. On the contrary, many such women have borne children without difficulty.

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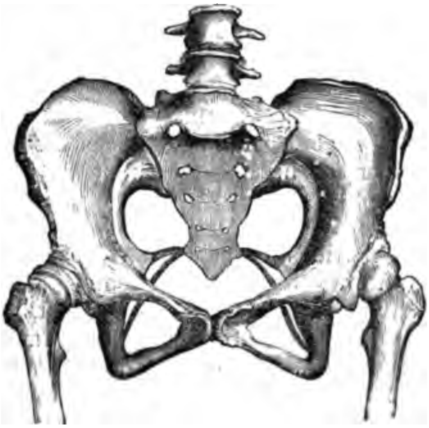
[1] Stanesco, Recherches cliniques sur les Rétrécissements du Bassin.

The Undeveloped Pelvis.—In some cases we have a pelvis which retains its infantile characteristics after puberty (Fig. 121). In these the normal development of the pelvis has been in some way interfered with, possibly from premature ossification of the different portions of the innominate bones, or from arrest of their growth by a weakly or rachitic constitution. The measurements of these pelves are not always below the normal standard; they may continue to grow, although they have not developed. The proportionate measurements of the various diameters will then be as in the infant; and the antero-posterior diameter may be longer than, or as long as, the transverse, the ischia comparatively near each other, and the pubic arch narrow. Such a form of pelvis will interfere with the mechanism of delivery, and unusual difficulty in labor will be experienced. Difficulties from a similar cause may be expected in pregnancies occurring in very young girls. Here, however, there is reason to hope that, as age advances, the pelvis will develop, and subsequent labors be more easy.

FIG. 121.



ADULT PELVIS RETAINING ITS INFANTILE TYPE.

The *masculine*, or funnel-shaped, pelvis owes its name to its approximation to the type of the male pelvis. The bones are thicker and stouter than usual, the conjugate diameter of the brim longer, and the whole cavity rendered deeper and narrower at its lower part by the nearness of the ischial tuberosities. It is generally met with in strong muscular women following laborious occupations, and Dr. Barnes, from his experience in the Royal Maternity Charity, says that it chiefly occurs in weavers in the neighborhood of Bethnal Green, who spend most of their time in the sitting posture. "The cause of this form of pelvis seems to be an advanced condition of ossification in a pelvis which would otherwise have been *infantile,* brought about by the development of unusual muscularity, corresponding to the laborious employment of the individual." The difficulties in labor will naturally be met with towards the outlet, where the funnel shape of the cavity is most apparent.

Diminution of the antero-posterior diameter is most frequently limited to the brim, and is by far the most common variety of pelvic deformity. In its slighter degrees it is not necessarily dependent on rickets, although when more marked it almost invariably is so. When unconnected with rickets, it probably can be traced to some injurious influence before the bones have ossified, such as increased pressure of the trunk from carrying weights in early childhood, and the like. By this means the sacrum is unduly depressed, and projects forwards, so as to slightly narrow the conjugate diameter.

When caused by rickets, the amount of the contraction varies greatly, sometimes being very slight, sometimes sufficient to prevent the passage of the child altogether and necessitate craniotomy or the Cæsarean section. The sacrum, softened by the disease, is pressed vertically downwards by the weight of the body, its descent being partially resisted by the already ossified portions of the bone, so that the result is a downward and forward movement of the promontory. The upper portion of the sacral concavity is thus directed more backwards; but, as the apex of the bone is drawn forwards by the attachment of the perineal muscles to the coccyx, and by the sacro-ischiatic ligaments, a sharp curve of its lower part in a forward direction is established.

The depression of the sacral promontory would tend to produce strong traction, through the sacro-iliac ligaments, on the posterior ends of the sacro-cotyloid beams, and thus induce expansion of the iliac bones, and consequent increase of the transverse diameter of the brim. So an unusual length of the transverse diameter is very often described as accompanying this deformity; but probably it is not so often apparent as might otherwise be expected, on account of the imperfect development of the bones generally accompanying rickets; and Barnes[1] says that in the parts of London where deformities are most rife, any enlargement of the transverse diameter is exceedingly rare. Frequently the sacrum is not only depressed, but displaced more or less to one side, most generally to the left, thus interfering with the regular shape of the deformed brim. This is often the result of a lateral flexion of the spinal column, depending on the rachitic diathesis.

In most cases of this kind the cavity of the pelvis is not diminished in size, and is often even more than usually wide. The constant pressure on the ischia, which the sitting posture of the child entails, tends to force them apart, and also to widen the pubic arch. Considerable advantage results from this in cases in which we have to perform obstetric operations, as it gives plenty of room for manipulation.

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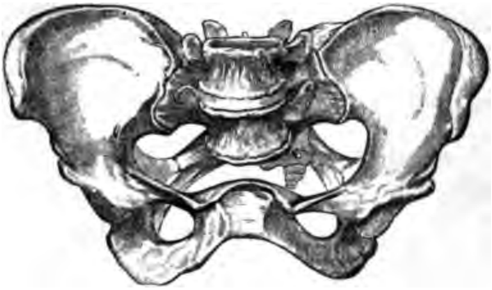
[1] Lectures on Obst. Operations, p. 280.

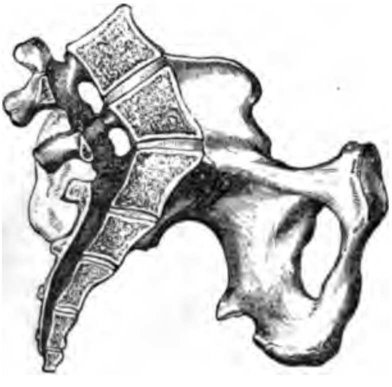
Figure-of-Eight Deformity.—In a few exceptional cases the narrowing of the conjugate diameter is increased by a backward depression of the symphysis pubis, which gives the pelvic brim a sort of figure-of-eight shape (Fig. 122). The most reasonable explanation of this peculiarity seems to be, that it is the result of the muscular contraction of the recti muscles at their point of attachment, when the centre of gravity of the body is thrown backwards, on account of the projection of the sacral promontory. Sometimes also the antero-posterior diameter of the cavity is unusually lessened by the disappearance of the vertical curvature of the sacrum, which, instead of forming a distinct cavity, is nearly flat (Fig. 123).

Fig. 122.



RICKETY PELVIS. WITH BACKWARD DEPRESSION OF THE SYMPHYSIS PUBIS.

Fig. 123.

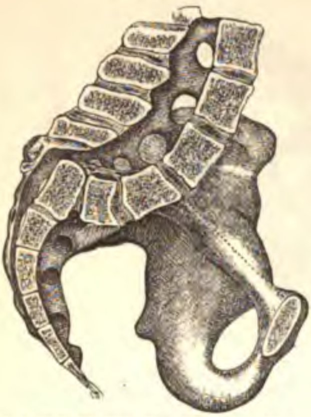


FLATNESS OF SACRUM WITH NARROWING OF PELVIC CAVITY.

Spondylolithesis.—In a few rare cases, to which attention was first called in 1853 by Kilian, of Bonn, a very formidable narrowing of the conjugate diameter of the pelvic brim is produced by a downward displacement of the fourth and fifth lumbar vertebræ, which become dislocated forwards, or, if not actually dislocated, at least separated from their several articulations to a sufficient extent to encroach very seriously on the dimensions of the pelvic inlet. This condition is known as *spondylolithesis* (Fig. 124).

The effect of this is sufficiently obvious; for the projection of the lumbar vertebræ takes the place of the sacral promontory, and prevents the passage of the child. To such an extent is obstruction thus produced, that in the majority of the recorded cases the Cæsarean section was found to be necessary. The true conjugate diameter, that between the promontory of the sacrum and the symphysis pubis, is increased rather than diminished; but for all practical purposes the condition is similar to extreme narrowing of the conjugate from rickets, for the bodies of the displaced vertebræ project into and obstruct the pelvic brim.

FIG. 124.

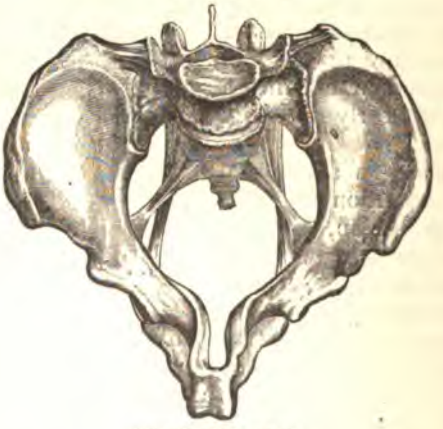


PELVIS DEFORMED BY SPONDYLOLITHESIS.

The cause of this deformity seems to be different in different cases. In some it seems to have been congenital, and in others to have depended on some antecedent disease of the bones, such as tuberculosis or scrofula, producing inflammation and softening of the connection between the last lumbar vertebræ and the sacrum, thus permitting downward displacement of the bones. Lambl believed that it generally followed spina bifida which had become partially cured, but which had produced deformity of the vertebræ and favored their dislocation. Brodhurst,[1] on the other hand, thinks that it most probably depends on rachitic inflammation and softening of the osseous and ligamentous structures, and that it is not a dislocation in the strict sense of the word.

Narrowing of the Oblique Diameter.—The most marked examples of narrowing of both oblique diameters depend on osteo-malacia. In this disease, as has already been remarked, the bones are uniformly softened; and the alterations in form are further influenced by the fact that the disease commences after union of the separate portions of the os innominatum has been completely effected. The amount of deformity in the

FIG. 125.



OSTEO-MALACIC PELVIS.

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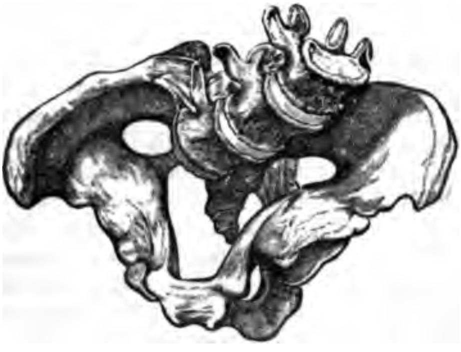
[1] Obst. Trans., vol. vi. p. 97.

worst cases is very great, and frequently renders delivery impossible without the Cæsarean section. Sometimes the softening of the bones proves of service in delivery, by admitting of the dilatation of the contracted pelvic diameter by the pressure of the presenting part, or even by the hand. Some curious cases are on record, in which the deformity was so great as to apparently require the Cæsarean section, but in which the softened bones eventually yielded sufficiently to render this unnecessary.

The weight of the body depresses the sacrum in a vertical direction, and at the same time compresses its component parts together, so as to approximate the base and apex of the bone, and narrow the conjugate diameter of the brim, by causing the promontory to encroach upon it. The most characteristic changes are produced by the pushing inwards of the lateral walls of the pelvis at the cotyloid cavities, in consequence of the pressure exerted at these points through the femurs. The effect of this is to bring together the sides of the pelvis, and diminish both oblique diameters, giving the brim somewhat the shape of a trefoil, or an ace of clubs. The sides of the pubis are at the same time approximated, and may become almost parallel, when the true conjugate may be even lengthened (Fig. 125). The tuberosities of the ischia are also compressed together, with the rest of the lateral pelvic wall, so that the outlet is greatly deformed as well as the brim (Fig. 126).

FIG. 126.



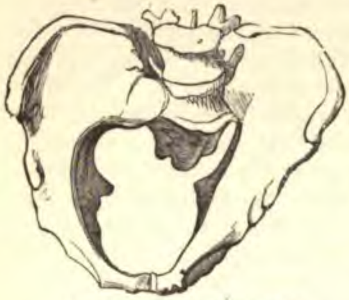
EXTREME DEGREE OF OSTEO-MALACIC DEFORMITY.

Obliquely Contracted Pelvis.—That form of deformity in which one oblique diameter only is lessened, has received considerable attention, from having been made the subject of special study by Naegele, and is generally known as the *obliquely contracted pelvis* (Fig. 127). It is a condition that is very rarely met with, although it is interesting from an obstetric point of view, as throwing considerable light on the mode in which the natural development of the pelvis is effected. It is also difficult to diagnose, inasmuch as there is no apparent external deformity to lead us to suspect pelvic disease, and probably it has never, in fact, been detected before delivery. It has a very serious influence on the labor; Litzman found that out of 28 cases of this deformity, 22 died in their first labors, and 5 more in subsequent deliveries. The prognosis, therefore, is very formidable, and renders a knowledge of this distortion, rare though it be, of much importance.

Its essential characteristic is flattening and want of development of one side of the pelvis, associated with anchylosis of the corresponding sacro-iliac synchondrosis. The latter is probably always present, and it seems to be most generally a congenital malformation. The lateral half of the sacrum on the same side, and the entire innominate bone, are much atrophied. The promontory of the sacrum is directed towards the diseased side, and the symphysis pubis is pushed over towards the healthy side.

The main agent in the production of this deformity is the absence of the sacro-iliac joint, which prevents the proper lateral expansion of the pelvic brim on that side, and allows the counter-pressure, through the femur, to push in the atrophied os innominatum to a much greater extent than usual. The chief diminution in the length of the pelvic diameter is between the ilio-pectineal eminence of the affected side and the healthy sacro-iliac joint; while the oblique diameter between the anchylosed joint and the healthy os innominatum is of normal length.

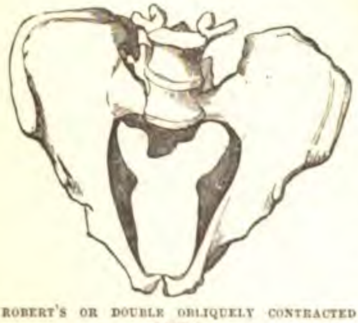
FIG. 127.



OBLIQUELY CONTRACTED PELVIS.

Transverse contraction of the pelvic brim is very much less common than narrowing of the conjugate diameter. It most frequently depends on backward curvature of the lower parts of the spinal column, in consequence of disease of the vertebræ. This form of deformed pelvis is generally known as the *kyphotic*. The effect of the spinal curvature is to drag the promontory of the sacrum backwards, so that it is high up and out of reach. By this means the antero-posterior diameter of the brim is increased, while the transverse is lessened; the relative proportion between the two is thus reversed. While the upper portion of the sacrum is displaced backwards, its lower end is projected forwards, so that the antero-posterior diameters of the cavity and outlet are considerably diminished. The ischial tuberosities are also nearer to each other, and the pubic arch is narrowed. In this deformity it will be observed that the obstruction to delivery will be chiefly met with at the outlet and lower parts of the pelvic cavity; for, although the transverse diameter of the brim is narrowed, there is generally sufficient space for the passage of the head.

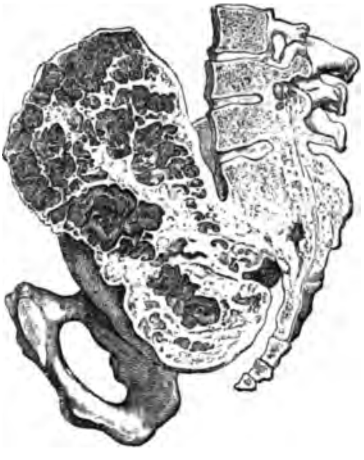
FIG. 128.



ROBERT'S OR DOUBLE OBLIQUELY CONTRACTED PELVIS.

Another form of transversely contracted pelvis is known as *Robert's* pelvis (Fig. 128), having been first described by Robert, of Coblentz. It is in fact a double obliquely contracted pelvis, depending on anchylosis of the sacro-iliac joints on both sides, and consequent defective development of both innominate bones. The shape of the pelvic brim is markedly oblong, and the sides of the pelvis are more or less parallel with each other. The outlet is also much contracted in the transverse direction. The amount of obstruction is very great, so that, according to Schroeder, out of 7 well-authenticated cases the Cæsarean section was required in 6.

FIG. 129.



BONY GROWTH FROM SACRUM OBSTRUCTING THE PELVIC CAVITY.

Deformity from Hip-Joint Disease.—Another cause of transverse deformity, occasionally met with, is luxation of the head of the femur, depending on old-standing joint disease. The head of the femur, in this case, presses on the innominate bone at the site of dislocation, and the result is that the iliac fossa on the affected side, or both if the accident happens on both sides, is pushed inwards, while the transverse diameter of the brim is lessened. The tuberosity of the ischium is, however, projected outwards, so that the outlet of the pelvis is increased rather than diminished.

Deformity from Tumors, Fractures, &c.—Obstruction of the pelvic cavity from exostosis or other forms of tumors growing from the bones is described in most obstetric works, although the condition is one of great rarity (Fig. 129). It may, however, be met with, and produce very serious dystocia. Several curious examples are collected in Mr. Wood's article on the pelvis, in some of which the obstruction was so great as to necessitate the Cæsarean section. Some of these growths were true bony exostoses; others osteo-sarcomatous tumors attached to the pelvic bones, most generally the upper part of the sacrum; and others were malignant. In some cases, probably connected with the gouty or rheumatic diathesis, spiculæ of bone have developed about the linea ilio-pectinea or other parts of the pelvis, which may not be sufficient to produce obstruction, but which may injure the uterus, or even the fœtal head, when they are pressed upon them. Irregular projections may also arise from the callus of old fractures of the pelvic bones. All such cases defy classification, and differ so greatly in their extent, and in their effect on labor, that no rules can be laid down for them, and each must be treated on its own merits.

The *effects of pelvic contractions on labor* vary, of course, greatly with the amount and nature of the deformity; but they must always give rise to anxiety, and in the graver degrees they produce the most serious difficulties we have to contend with in the whole range of obstetrics.

In the slighter degrees, in which the proportion between the presenting part and the pelvis is only slightly altered, we may observe little abnormal beyond a greater intensity of the pains and some protraction of the labor. It is generally observed that the uterine contractions are strong and forcible in cases of this kind, probably because of the increased resistance they have to contend against; and this is obviously a desirable and conservative occurrence, which may, of itself, suffice to overcome the difficulty. The first stage, however, is not unfrequently prolonged, and the pains are ineffective, for the head does not readily engage in the brim, the uterus is more mobile than in ordinary labors, and it probably acts at a disadvantage.

Risk to the Mother.—In the more serious cases, the mother is obviously subjected to many risks, directly proportionate to the amount of obstruction and the length of the labor. The long-continued and excessive uterine action produced by the vain endeavors to push the child through the contracted pelvic canal, the more or less prolonged contusion and injury to which the maternal soft parts are necessarily subjected (not unfrequently ending in inflammation and sloughing, with all its attendant dangers), and the direct injury which may be inflicted by the measures we are compelled to adopt for aiding delivery (such as the forceps, turning, craniotomy, or even the almost inevitably fatal Cæsarean section), all tend to make the prognosis of these cases a matter of grave anxiety.

Risk to the Child.—Nor are the dangers less to the child; and a very large proportion of still-births will always be met with. The infantile mortality may be traced to a variety of causes, the most important being the protraction of the labor and the continuous pressure to which the presenting part is subjected. For this reason, even in cases in which the contraction is so slight that the labor is terminated by the natural powers, it has been estimated that 1 out of every 5 children is still-born; and as the deformity increases in amount, so, of course, does the prognosis to the child become more unfavorable.

Prolapse of the umbilical cord is well known to be of very frequent occurrence in cases of pelvic deformity, the tendency to this accident being traceable to the fact of the head not entering and occupying the upper strait of the pelvis as in ordinary labors, and thus leaving a space through which the cord may descend. So frequently is this complication met with in pelvic deformity that Stanesco[1] found it had happened as often as 59 times in 414 labors; and when the dangers of prolapsed funis are added to those of protracted labors, it is hardly a matter of surprise that the occurrence should, under such circumstances, almost always prove fatal to the child.

Injury to Child's Head.—The head of the child is also liable to injury of a more or less grave character from the compression to which it is subjected, especially by the promontory of the sacrum. Independently of the transient effects of undue pressure (temporary alteration of the shape of the bones and evidences of bruising of the scalp), there is often met with a more serious depression of the bones of the skull, produced by the pressure of the promontory. This is most marked in cases in which the head has been forcibly dragged past the projecting bone by the forceps, or after turning. The amount of depression varies with the degree of contraction; but sometimes it must be admitted that, were it not for the yielding of the bones of the fœtal skull in this way, delivery, without lessening the size of the head by perforation, would be impossible. Such depressions are found at the spot immediately opposite the promontory, generally at the side of the skull near the junction of the frontal and parietal bones. Sometimes there is a slight permanent mark left, but more often the depression disappears in a few days. The prognosis to the child is, however, grave when the contraction has been sufficient to indent the skull in this way; for it has been found that 50 per cent. of the children thus marked died either immediately or shortly after labor.[1]

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[1] Op. cit., p. 94.

Course of Labor.—The means which nature takes to overcome these difficulties are well worthy of study, and there are certain peculiarities in the mechanism of delivery when pelvic deformities exist, which it is of importance to understand, as they guide us in determining the proper treatment to adopt.

Malpresentations of the fœtus are of much more frequent occurrence than in ordinary labors; partly because the head does not engage readily in the brim, but, remaining free above it, is apt to be pushed away by the uterine contractions; and partly because of the alteration of the axis of the uterine tumor which is very often present. The extremely developed pendulous condition of the abdomen in cases of pelvic deformity is very obvious, so that the fundus is sometimes almost in a line with the cervix, and thus transverse or other abnormal positions are very frequently met with. It is to be noted, however, that we cannot regard breech presentations as so unfavorable as in ordinary labors, for the pressure from the contracted pelvis is less likely to be injurious when applied to the body than to the head of the child; and, indeed, as we shall presently see, the artificial production of these presentations is often advisable as a matter of choice.

Mechanism of Delivery in Head Presentations.—The mode in which the head passes naturally through a contracted pelvis is in some respects different from the ordinary mechanism of delivery in head presentations, and has been carefully worked out by Spiegelberg, and other German obstetricians.

The means which nature adopts to overcome this difficulty are different in cases in which there is a marked narrowing of the conjugate diameter of the brim, and in those in which there is a generally contracted pelvis.

In the former and more common deformity, when the head enters the brim, in consequence of the resistance it meets with at the contracted part, the expelling power of the uterus acts more on the anterior part of the head than in ordinary cases, the chin becomes in some degree separated from the sternum, and the anterior fontanelle descends somewhat lower than the posterior. At this stage, on examination, it will be found, supposing we have to do with a case in which the occiput points to the left side of the pelvis, that the anterior fontanelle is felt lower than the posterior, and to the right, the bi-temporal diameter of the head is engaged in the conjugate diameter of the brim (as the smallest diameter of the skull, there is manifest advantage in this), the bi-parietal diameter and the largest portion of the head points to the left side. The sagittal suture will be felt running across in the transverse diameter of the brim, but nearer to the sacrum, the head being placed obliquely. As the head is forced down by the uterine contractions, the posterior parietal bone, which is resting on the promontory, is pushed against it so that the sagittal suture is forced more into the true transverse diameter of the pelvic brim and approaches nearer to the pubes. The next step is the depression of the head, the occiput undergoing a sort of rotation on its transverse axis, so that it reaches a parallel plane below the brim. When this is accomplished, the rest of the head readily passes the obstruction. The forehead now meets with the resistance of the pelvic walls, the posterior fontanelle descends to a lower level, and, as the cavity of the pelvis in cases of antero-posterior contraction of the brim is generally of normal dimensions, the rest of the labor is terminated in the usual way.

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[1] Schroeder, op. cit., p. 256.

In the *generally contracted pelvis* the head enters the brim with the posterior fontanelle lowest, and it is after this that the resistance to its progress becomes manifest. The result is, therefore, an exaggeration of what is met with in ordinary cases. The resistance to the anterior or longer arm of the lever is greater than that to the occipital or shorter; and, therefore, the flexion of the head becomes very marked. The posterior fontanelle is consequently unusually depressed, and the anterior quite out of reach. So the head is forced down as a wedge, and its farther progress must depend upon the amount of contraction. If this be not too great, the anterior fontanelle eventually descends, and delivery is completed in the usual way. Should the contraction be too much to permit of this, the head becomes jammed in the pelvis, and diminution of its size may be essential.

In cases of deformity of the conjugate diameter, combined with general contraction of the pelvis, the mechanism partakes of the peculiarities of both these classes, to a greater or less extent, in proportion to the preponderance of one or other species of deformity.

Diagnosis.—It rarely happens that deformities of the pelvis, except of the very gravest kind, are suspected before labor has actually commenced; and therefore we are not often called upon to give an opinion as to the condition of the pelvis before delivery. Should we be so, there are various circumstances which may aid us in arriving at a correct conclusion. Prominent among them is the history of the patient in childhood. If she be known to have suffered from rickets in early life, more especially if the disease has left evident traces in deformities of the limbs, or in a dwarfed and stunted growth, or in curvature of the spine, there will be strong presumptive evidence of pelvic deformity; a markedly pendulous state of the uterine tumor may also tend to confirm the suspicion. Nothing short of a careful examination of the pelvis itself will, however, clear up the point with certainty; and even by this means, to estimate the precise degree of deformity with accuracy requires considerable skill and practice. The ingenuity of practitioners has been much exercised, it might perhaps be justly said wasted, in the invention of various more or less complicated pelvimeters for aiding us in obtaining the desired object. It is, however, pretty generally admitted by all accoucheurs that the hand forms the best and most reliable instrument for this purpose, at any rate as regards the interior of the pelvis; although a pair of callipers, such as Baudelocque's well-known instrument, is essential for accurately determining the external measurements. The objections to all internal pelvimeters, even those most simple in their construction, are their cost and complexity, and the impossibility of using them without pain or injury to the patient.

External Measurements.—It was formerly thought that by measuring the distance between the spinous processes of the sacrum and the symphysis pubis, and subtracting from it what we judge to be the thickness of the bones and soft parts, we might arrive at an approximate estimate of the measurement of the conjugate diameter of the pelvic brim. It is now admitted that this method can never be depended on, and that it is practically useless. A change in the relative length of other external measurements of the pelvis is, however, often of great value in showing the existence of deformity internally, although not in judging of its amount. The measurements which are used for this purpose are between the anterior superior spines of the ilium, and between the centres of the crests of the ilia, averaging respectively 9½ and 10½ inches. According to Spiegelberg, these measurements may give one of three results.

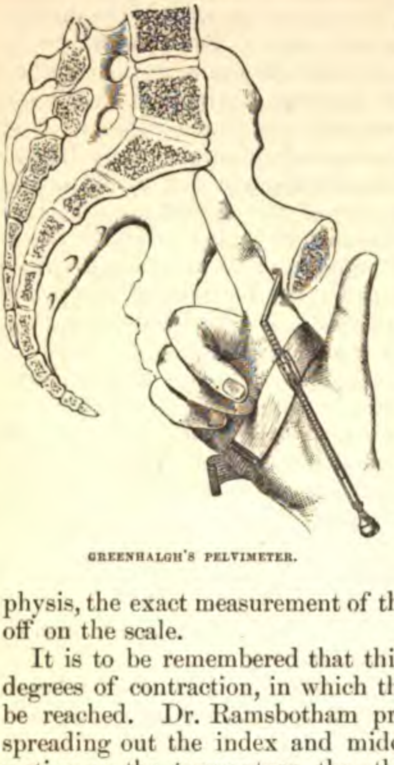
1. Both may be less than they ought to be, but the relation of the one to the other remains unchanged.
2. That between the crests is not, or is at most very little, diminished, but that between the spinous processes is increased.
3. Both are diminished, but at the same time their mutual relation is not normal, the distance between the spines being as long as, if not longer than, that between the crests.

No. 1 denotes a uniformly contracted pelvis; No. 2, a pelvis simply contracted in the conjugate diameter of the brim, and not otherwise deformed; No. 3, a pelvis with narrowed conjugate and also uniformly contracted, as in the severe type of rachitic deformity.

For the purpose of making these measurements Baudelocque's *compas d'épaisseur* can be used, or Dr. Lazarewitch's elegant universal pelvimeter, which can be adopted also for internal pelvimetry; but, in the absence of these special contrivances, an ordinary pair of callipers, such as are used by carpenters, can be made to answer the desired object.

Internal Measurements.—These external measurements must be corroborated by internal, chiefly of the antero-posterior diameter, by which alone we can estimate the amount of the deformity. We endeavor to find, in the first place, the length of the diagonal conjugate, between the lower edge of the symphysis pubis and the promontory of the sacrum, which averages about half an inch more than the true conjugate. The patient lying in the usual obstetric position, an attempt is made to reach the promontory of the sacrum with the tip of the index finger. In a healthy pelvis this is impossible: so that the mere fact of our being able to do so proves the existence of contraction. A mark is made with the nail of the index of the left hand on that part of the examining finger which rests under the symphysis, and then the distance from this to the tip of the finger, less half an inch, may be taken to indicate the measurement of the true conjugate of the brim. Various pelvimeters are meant to make the same measurements, such as Lumley Earle's, Lazarewitch's, which is similar in principle, and Van Huevel's. The best and simplest, I think, is that invented by Dr. Greenhalgh (Fig. 130). It consists of a movable rod, attached to a flexible band of metal which passes around the palm of the examining hand. At the distal end of the rod is a curved portion, which passes over the radial edge of the index finger. The examination is made in the usual way, and when the point of the finger is resting on the promontory of the sacrum, the rod is withdrawn until it is arrested by the posterior surface of the symphysis, the exact measurement of the diagonal conjugate being then read off on the scale.

FIG. 130.



GREENHALGH'S PELVIMETER.

It is to be remembered that this procedure is useless in the slighter degrees of contraction, in which the promontory of the sacrum cannot be reached. Dr. Ramsbotham proposes to measure the conjugate by spreading out the index and middle fingers internally, the tip of one resting on the promontory, the other behind the pubis; and then withdrawing them, in the same position, and measuring the distance between them. This manœuvre I believe to be impracticable.

Whenever, in actual labor, we wish to ascertain the condition of the pelvis accurately, the patient should be anæsthetized, and the whole hand introduced into the vagina (which could not otherwise be done without causing great pain), and the proportions of the pelvis, and the relations of the head to it, thoroughly explored; and, if what has been said as to the mechanism of delivery in these cases be borne in mind, this may aid us in determining the kind of deformity existing. In this way contractions about the outlet of the pelvis can also be pretty generally made out.

The *obliquely contracted pelvis* cannot be determined by any of these methods, but certain external measurements, as Naegele has pointed out, will readily enable us to recognize its existence. It will be found that measurements which in the healthy pelvis ought to be equal are unequal in the obliquely distorted pelvis. The points of measurement are chiefly: 1, from the tuberosity of the ischium on one side to the posterior superior spine of the ilium on the other; 2, from the anterior superior iliac spine on the one side to the posterior superior on the opposite; 3, from the trochanter major of one side to the posterior superior iliac spine on the other; 4, from the lower edge of the symphysis pubis to the posterior superior iliac spine; 5, from the spinous process of the last lumbar vertebra to the anterior superior spine of the ilium on either side.

If these measurements differ from each other by half an inch to an inch, the existence of an obliquely deformed pelvis may be safely diagnosed. The diagnosis can be corroborated by placing the patient in the erect position, and letting fall two plumb-lines, one from the spines of the sacrum, the other from the symphysis pubis. In a healthy pelvis these will fall in the same plane, but in the oblique pelvis the anterior line will deviate considerably towards the unaffected side.

Treatment.—The proper management of labor in contracted pelvis is, even up to this time, one of the most vexed questions in midwifery, notwithstanding the immense amount of discussion to which it has given rise; and the varying opinions of accoucheurs of equal experience afford a strong proof of the difficulties surrounding the subject. This remark applies, of course, only to the lesser degrees of deformity, in which the birth of a living child is not hopeless. When the antero-posterior diameter of the brim measures only 3 inches or less, it is universally admitted that the destruction of the child is inevitable, unless the pelvis be so small as to necessitate the performance of the Cæsarean section. But when it is between 3 inches and the normal measurement the comparative merits of the forceps, turning, and the induction of premature labor, form a fruitful theme for discussion. With one class of accoucheurs the forceps are chiefly advocated, and turning admitted as an occasional resource when they have failed; and this, indeed, speaking broadly, may be said to have been the general view held in this country. More recently we find German authorities of eminence, such as Schroeder and Spiegelberg, giving turning the chief place, and condemning the forceps altogether in contracted pelvis, or, at least, restricting their use within very narrow limits. More strangely still, we find, of late, that the induction of premature labor, on the origination and extension of which British accoucheurs have always prided themselves, is placed without the pale, and spoken of as injurious and useless in reference to pelvic deformities. To see our way clearly amongst so many conflicting opinions is by no means an easy task; and perhaps we may best aid in its accomplishment by considering separately the three operations in so far as they bear on this subject, and pointing out briefly what can be said for and against them.

The Forceps.—In England and in France it is pretty generally admitted that in the slighter degrees of contraction the most reliable means of aiding the patient is the application of the forceps. It should be remembered that the operation, under such circumstances, is always much more serious than in ordinary labors simply delayed from uterine inertia, when there is ample room and the head is in the cavity of the pelvis; for the blades have to be passed up very high, often when the head is more or less movable above the brim, and much more traction is likely to be required. For these reasons, artificial assistance, when pelvic deformity is suspected, is not to be lightly or hurriedly resorted to. Nor, fortunately, is it always necessary; for, if the pains be sufficiently strong, and the contraction not too great to prevent the head engaging at all, after a lapse of time it will become so moulded in the brim as to pass even a considerable obstruction. In all cases, therefore, sufficient time must be given for this; and, if no suspicious symptoms exist on the part of the mother—no elevation of temperature, dryness of the vagina, rapid pulse, and the like, and the fœtal heart sounds continue to be normal—labor may be allowed to go on for some hours after the rupture of the membranes, so as to give nature a chance of completing the delivery. When this seems hopeless, the intervention of art is called for.

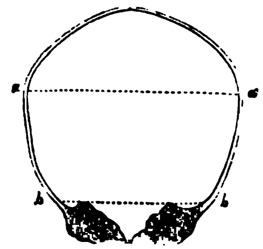
The forceps are generally considered to be applicable in all degrees of contraction from the standard measurement, down to about 3¼ inches in the conjugate of the brim. There can be no doubt that, in such cases, traction with the forceps often enables us to effect delivery, when the natural efforts have proved insufficient, and holds out a very fair hope of saving the child. Out of 17 cases in which the high forceps operation was resorted to for pelvic deformity, reported by Stanesco, in 13 living children were born. If the length of the labor, and the long-continued compression to which the child had been subjected, be borne in mind, this result must be considered very favorable.

Objections that have been raised to the Forceps.—What are the objections which have been brought against the operation? These have been principally made by Schroeder and other German writers. They are, chiefly, the difficulty in passing the instrument; the risk of injuring the maternal structures; and the supposition that, as the blades must seize the head by the forehead and occiput, their compressive action will diminish its longitudinal and increase its transverse diameter (which is opposed to the contracted part of the brim), and so enlarge the head just where it ought to be smallest. There is little doubt that these writers much exaggerate the compressive power of the forceps. Certainly with those generally used in this country, any disadvantage likely to accrue from this is more than counterbalanced by the traction on the head; and the fact that minor degrees of obstruction can be thus overcome, with safety both to the mother and child, is abundantly proved by the numberless cases in which the forceps have been used.

It is very likely that the forceps do not act equally well in all cases. When the head is loose above the brim; when the contraction is chiefly limited to the antero-posterior diameter, and there is abundance of room at the sides of the pelvis for the occiput to occupy after version; and when, as is usual in these cases, the anterior fontanelle is depressed and the head is placed in a very oblique position, it is probable that turning may be the safer operation for the mother, and the easier performed. When, on the other hand, the head has engaged in the brim, and has become more or less impacted, it is obvious that version could not be performed without pushing it back, which may neither be easy nor safe. It is probable also that in the generally contracted pelvis, in which the contraction is not limited to the conjugate diameter, and in which the head enters in an exaggerated state of flexion, the posterior fontanelle being much depressed, the forceps are more suitable.

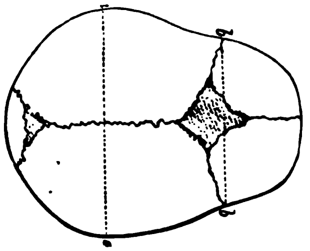
The special reasons why version sometimes succeeds when the forceps fail, or why it may be elected from the first as a matter of choice, have been by no one better pointed out than by Sir James Simpson. Although the operation was performed by many of the older obstetricians, its revival in modern times, and the clear enunciation of its principles, can undoubtedly be traced to his writings. He points out that the head of the child is shaped like a cone, its narrowest portion, the base of the cranium (Fig. 131 *b b*), measuring, on an average, from ½ to ⅔ of an inch less than the broadest portion (Fig. 131 *a a*), viz., the bi-parietal diameter. In ordinary head presentations the latter part of the head has to pass first; but if the feet are brought down, the narrow apex of the cranial cone is brought first into apposition with the contracted brim, and can be more easily *drawn* through than the broader base can be *pushed* through by the uterine contractions. Nor is this the only advantage, for, after turning, the narrower bi-temporal diameter (Fig. 132 *b b*)—which measures, on an average, half an inch less than the bi-parietal (Fig. 132 *a a*)—is brought into contact with the contracted conjugate, while the broader bi-parietal lies in the comparatively wide space at the side of the pelvis (Fig. 133). These mechanical considerations are sufficiently obvious, and fully explain the success which has often attended the performance of the operation.

FIG. 131.



SECTION OF FŒTAL CRANIUM, SHOWING ITS CONICAL FORM.

FIG. 132.



SHOWING THE GREATER BREADTH OF THE BI-PARIETAL DIAMETER OF THE FŒTAL CRANIUM.

It is generally admitted that it may be possible, for the reasons just mentioned, to deliver a living child by turning, through a pelvis contracted beyond the point which would permit of a living child being extracted by the forceps. Many obstetricians believe that it is possible to deliver a living child by turning in a pelvis contracted even to the extent of 2¾ inches in the conjugate diameter. Barnes maintains that, although an unusually compressible head may be drawn through a pelvis contracted to 3 inches, the chance of the child being born alive under such circumstances must necessarily be small, and that from 3¼ inches to the normal size must be taken as the proper limits of the operation.

That delivery is often possible by turning, after the forceps and the natural powers have failed, and when no other resource is left but the destruction of the child, must, I think, be admitted by all; for the records of obstetrics are full of such cases. To take one example only, Dr. Braxton Hicks[1] records 4 cases in which the forceps were tried unsuccessfully, in all of which version was used, 3 of the children being born alive. Here are the lives of 3 children rescued from destruction, within a short period, in the practice of one man; and a fact like this would of itself be ample justification of the attempt to deliver by turning, when the child was known to be alive, and other means had failed. The possibility that craniotomy may still be required, is no argument against the operation; for, although perforation of the after-coming head is certainly not so easy as perforation of a presenting head, it is not so much more difficult as to justify the neglect of an expedient by which it may possibly be altogether avoided.

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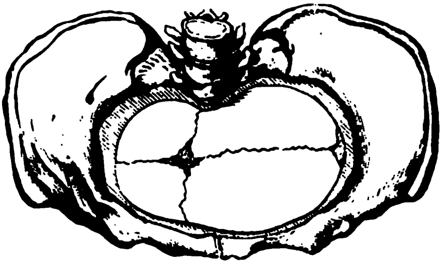
[1] Guy's Hosp. Rep., 1870.

FIG. 133.



SHOWING THE GREATER SPACE FOR THE BI-PARIETAL DIAMETER AT THE SIDE OF THE PELVIS IN CERTAIN CASES OF DEFORMITY.

The original choice of turning is a more difficult question to decide. My own impression is that the forceps will generally be found to be the preferable operation of the two—except, perhaps, when the head refuses to enter the brim and cannot be sufficiently steadied by external pressure to admit of the easy application of the instrument. An argument used by Martin, of Berlin,[1] in reference to the two operations, should not be lost sight of, as it seems to be a valid reason for giving a preference to the forceps. He points out that moulding may safely be applied for hours to the vertex; but that when pressure is applied to the important structures about the base of the brain, as after turning, moulding cannot be continued beyond five minutes without proving fatal. This, however, is no reason why turning should not be used after the forceps and the natural efforts have proved ineffectual.

When the contraction is below 3 inches in the conjugate, or when the forceps and turning have failed, no resource is left but the destruction of the fœtus, or the Cæsarean section.

The induction of premature labor as a means of avoiding the risks of delivery at term, and of possibly saving the life of the child, must now be studied. The established rule, in this country, is that in all cases of pelvic deformity the existence of which has been ascertained either by the experience of former labors, or by accurate examination of the pelvis, labor should be induced previous to the full period, so that the smaller and more compressible head of the premature fœtus may pass, where that of the fœtus at term would not. The gain is a double one, partly the lessened risk to the mother, and partly the chance of saving the child's life.

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[1] Mon. f. Geburt. 1867.

Recent Objections to it.—The practice is so thoroughly recognized as a conservative and judicious one, that it might be deemed unnecessary to argue in its favor, were it not that some most eminent authorities have of late years tried to show that it is better and safer to the mother to leave the labor to come on at term, and that the risk to the child is so great in artificially induced labor as to lead to the conclusion that the operation should be altogether abandoned, except, perhaps, in the extreme distortion in which the Cæsarean section might otherwise be necessary. Prominent amongst those who hold these views are Spiegelberg and Litzman, and they have been supported, in a modified form, by Matthews Duncan. Spiegelberg[1] tries to show, by a collection of cases from various sources, that the results of induced labor in contracted pelvis are much more unfavorable than when the cases are left to nature; that in the latter the mortality of the mothers is 6.6 per cent., and of the children 28.7 per cent., whereas in the former the maternal deaths are 15 per cent., and the infantile 66.9 per cent. Litzman[2] arrives at not very dissimilar results, namely, 6.9 per cent. of the mothers and 20.3 per cent. of the children in contracted pelvis at term, and 14.7 per cent. of the mothers and 55.8 per cent. of the children in artificially induced premature labor.

If these statistics were reliable, inasmuch as they show a very decided risk to the mother, there might be great force in the argument that it would be better to leave the cases to run the chance of delivery at term. It is, however, very questionable whether they can be taken in themselves as being sufficient to settle the question. The fallacy of determining such points by a mass of heterogeneous cases, collected together without a careful sifting of their histories, has over and over again been pointed out; and it would be easy enough to meet them by an equal catalogue of cases in which the maternal mortality is almost nil. The results of the practice of many authorities are given in Churchill's work, where we find, for example, that out of 46 cases of Merriman's not one proved fatal. The same fortunate result happened in 62 cases of Ramsbotham's. His conclusion is that "there is undoubtedly some risk incurred by the mother, but not more than by an accidental premature labor," and this conclusion, as regards the mother, is that which has long ago been arrived at by the majority of British obstetricians, who undoubtedly have more experience of the operation than those of any other nation. With regard to the child, even if the German statistics be taken as reliable, they would hardly be accepted as contra-indicating the operation, inasmuch as it is intended to save the mother from the dangers of the more serious labor at term, and, in many cases, to give at least a chance to the child, whose life would otherwise be certainly sacrificed. The result, moreover, must depend to a great extent on the method of operation adopted, for many of the plans of inducing labor recommended are certainly, in themselves, not devoid of danger both to the mother and the child. It may, I think, be admitted, as Dr. Duncan contends, that the operation has been more often performed than is absolutely necessary, and that the higher degrees of pelvic contraction are much more uncommon than has been supposed to be the case.[1] That is a very valid reason for insisting on a careful and accurate diagnosis, but not for rejecting an operation which has so long been an established and favorite resource.

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[1] Arch. f. Gyn., B. i. S. 1.

[2] Ib., B. ii. S. 169.

Determination of the Period for Inducing Labor.—When the induction of labor has been determined on, the precise period at which it should be resorted to becomes a question for anxious consideration, for the longer it is delayed the greater, of course, are the chances for the child. Many tables have been constructed to guide us on this point, which are not, on the whole, of so much service as they might appear to be, on account of the difficulty of determining with minute accuracy the amount of contraction. The following, however, which is drawn up by Scanzoni, may serve for a guide in settling this question:

		Inches		Lines						
When the sacro-pubic	diameter is	2	and	6	or	7	induce	labor at	30th	week.
"	"	2	"	8	"	9	"	"	31st	"
"	"	2	"	10	"	11	"	"	32d	"
"	"	3	"	—			"	"	33d	"
"	"	3	"	1			"	"	33d	"
"	"	3	"	2	"	3	"	"	34th	"
"	"	3	"	4	"	5	"	"	35th	"
"	"	3	"	5	"	6	"	"	36th	"

In cases of moderate deformity, when labor pains have been induced, the further progress of the case may be left to nature; but in the more marked cases, as in those below 3 inches, it will often be found necessary to assist delivery by turning or by the forceps, the former being here specially useful, on account of the extreme pliability of the head and the facility with which it may be drawn through the contracted brim. By thus combining the two operations it may be quite possible, as has been well shown by Barnes, to secure the birth of a living child even in pelves very considerably deformed.

Production of Abortion in Extreme Deformity.—When the contraction is so great as to necessitate the induction of the labor before the sixth month, or, in other words, before the child has reached a viable age, it would be preferable to resort to a very early production of abortion. The operation is then indicated, not for the sake of the child, but to save the mother from the deadly risk to which she would otherwise be subjected. As in these cases the mother alone is concerned, the operation should be performed as soon as we have positively determined the existence of pregnancy. No object can be gained by waiting until the development of the child is advanced to any extent, and the less the fœtus is developed the less will be the pain and risks the mother has to undergo. There is no amount of deformity, however great, in which we could not succeed in bringing on miscarriage by some of the numerous means at our disposal; and, in spite of Dr. Radford's objections, who maintains that the obstetrician is not justified in sacrificing the life of a living being more than once, when the mother knows that she cannot give birth to a viable child, there are few practitioners who would not deem it their duty to spare the mother the terrible dangers of the Cæsarean section.

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[1] Edin. Med. Journ., July, 1873, p. 339.

CHAPTER XIII.

HEMORRHAGE BEFORE DELIVERY: PLACENTA PRÆVIA.

THE hemorrhages which are the result of an abnormal situation of the placenta, partially or entirely, over the internal os uteri, have formed a most fruitful theme for discussion. The causes producing the abnormal placental site, the sources of the blood, and the causes of its escape, the means adopted by nature for its arrest, and the proper treatment, have, each and all of them, been the subject of endless controversies, which are not yet by any means settled. It must be admitted, too, that the extreme importance of the subject amply justifies the attention which has been paid to it; for there is no obstetric complication more apt to produce sudden and alarming effects, and none requiring more prompt and scientific treatment.

By *placenta prævia* we mean the insertion of the placenta at the lower segments of the uterine cavity, so that part of it is situated, wholly or partially, over the internal os uteri. In the former case there is what is talked of by authors as *complete* or *central* placental presentation; in the latter, an *incomplete* or *marginal* presentation.

The *causes* of this abnormal placental site are not fully understood. It was supposed by Tyler Smith to depend on the ovule not having been impregnated until it had reached the lower part of the uterine cavity. Cazeaux suggests that the uterine mucous membrane is less swollen and turgid than when impregnation occurs at the more ordinary place, and that, therefore, it offers less obstruction to the descent of the ovule to the lower part of the uterine cavity. An abnormal size, or unusual shape, of the uterine cavity may also favor the descent of the impregnated ovule. The former probably explains the fact that placenta prævia more generally occurs in women who have borne several children. These are merely interesting speculations having no practical value, the fact being undoubted that in a not inconsiderable number of cases—estimated by Johnson and Sinclair as 1 out of 573—the placenta is grafted partially or entirely over the uterine orifice.

Placenta prævia was not unknown to the older writers, who believed that the placenta had originally been situated at the fundus, from which it had accidentally fallen to the lower part of the uterus. Portal, Levret, Roederer, and especially our own countryman Rigby, were among those whose observations tended to improve the state of obstetrical knowledge as to its real site. To Rigby we owe the term "*unavoidable hemorrhage*" as a synonym for placenta prævia, and as distinguishing hemorrhage from this source from that resulting from separation of the placenta at its more usual position, termed by him, in contradistinction, "*accidental hemorrhage.*" These names, adopted by most writers on often performed than is absolutely necessary, and that the higher degrees of pelvic contraction are much more uncommon than has been supposed to be the case.[1] That is a very valid reason for insisting on a careful and accurate diagnosis, but not for rejecting an operation which has so long been an established and favorite resource.

Determination of the Period for Inducing Labor.—When the induction of labor has been determined on, the precise period at which it should be resorted to becomes a question for anxious consideration, for the longer it is delayed the greater, of course, are the chances for the child. Many tables have been constructed to guide us on this point, which are not, on the whole, of so much service as they might appear to be, on account of the difficulty of determining with minute accuracy the amount of contraction. The following, however, which is drawn up by Scanzoni, may serve for a guide in settling this question:

		Inches		Lines						
When the sacro-pubic	diameter is	2	and	6	or	7	induce	labor at	30th	week.
"	"	2	"	8	"	9	"	"	31st	"
"	"	2	"	10	"	11	"	"	32d	"
"	"	3	"	—			"	"	33d	"
"	"	3	"	1			"	"	33d	"
"	"	3	"	2	"	3	"	"	34th	"
"	"	3	"	4	"	5	"	"	35th	"
"	"	3	"	5	"	6	"	"	36th	"

In cases of moderate deformity, when labor pains have been induced, the further progress of the case may be left to nature; but in the more marked cases, as in those below 3 inches, it will often be found necessary to assist delivery by turning or by the forceps, the former being here specially useful, on account of the extreme pliability of the head and the facility with which it may be drawn through the contracted brim. By thus combining the two operations it may be quite possible, as has been well shown by Barnes, to secure the birth of a living child even in pelves very considerably deformed.

Production of Abortion in Extreme Deformity.—When the contraction is so great as to necessitate the induction of the labor before the sixth month, or, in other words, before the child has reached a viable age, it would be preferable to resort to a very early production of abortion. The operation is then indicated, not for the sake of the child, but to save the mother from the deadly risk to which she would otherwise be subjected. As in these cases the mother alone is concerned, the operation should be performed as soon as we have positively determined the existence of pregnancy. No object can be gained by waiting until the development of the child is advanced to any extent, and the less the fœtus is developed the less will be the pain and risks the mother has to undergo. There is no amount of deformity, however great, in which we could not succeed in bringing on miscarriage by some of the numerous means at our disposal; and, in spite of Dr. Radford's objections, who maintains that the obstetrician is not justified in sacrificing the life of a living being more than once, when the mother knows that she cannot give birth to a viable child, there are few practitioners who would not deem it their duty to spare the mother the terrible dangers of the Cæsarean section.

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[1] Edin. Med. Journ., July, 1873, p. 339.

On vaginal examination, if the os be sufficiently open to admit the finger, which it generally is on account of the relaxation produced by the loss of blood, we shall almost always be able to feel some portion of presenting placenta. If it be a central implantation, we shall find the upper aperture of the cervix entirely covered by the thick, boggy mass of the placenta, which is to be distinguished from a coagulum occupying the same position by its consistence, and by its not breaking down under the pressure of the finger. Through the placental mass we may be able to feel the presenting part of the fœtus, but not as distinctly as when there is no intervening substance. In partial placental presentations the bag of membranes, and above it the head or other presentation, will be found to occupy a part of the circle of the os, the rest being covered by the edge of the placenta. In marginal presentations we may only be able to make out the thickened edge of the after-birth, projecting at the rim of the os. If the cervix be high, and the gestation not advanced to term, these points may not be easy to make out, on account of the difficulty of reaching the cervix; and, as accurate diagnosis is of the utmost importance, it is proper to introduce two fingers, or even the whole hand, so as thoroughly to explore the condition of the parts. The lower portion of the uterine ovoid may be observed to be more than usually thick and fleshy; and Gendrin has pointed out that ballottement cannot be made out. The accuracy of our diagnosis may be confirmed, in doubtful cases, by finding that the placental bruit is heard over the lower part of the uterine tumor.

Dr. Wallace[1] has suggested that vaginal auscultation may be serviceable in diagnosis, and states that, by means of a curved wooden stethoscope, the placental bruit may be heard with startling distinctness. This is, however, a manœuvre that can hardly be generally carried out in actual practice.

The Source of Hemorrhage.—It is now pretty generally admitted by authorities that the immediate source of the hemorrhage is the lacerated utero-placental vessels. Only a few years ago Sir James Simpson advocated, with his usual energy, the theory, sustained by his predecessor Dr. Hamilton, that the chief, if not the only, source of hemorrhage was the detached portion of the placenta itself. He argued that the blood flowed from the portion of the placenta which was still adherent into that which was separated, and escaped from the surface of the latter; and on this supposition he based his practice of entirely separating the placenta, having observed that, in many cases in which the after-birth had been expelled before the child, the hemorrhage had ceased. The fact of the cessation of the hemorrhage, when this occurs, is not doubted; but Simpson's explanation is contested by most modern writers, prominent among whom is Dr. Barnes, who has devoted much study to the elucidation of the subject. He points out that the stoppage of the hemorrhage is not due to the separation of the placenta, but to the preceding or accompanying contraction of the uterus, which seals up the bleeding vessels, just as it does in other forms of hemorrhage. The site of the loss was actually demonstrated by the late Dr. Mackenzie in a series of experiments, in which he partially detached the placenta in pregnant bitches, and found that the blood flowed from the walls of the uterus, and not from the detached surface of the placenta. The arrangement of the large venous sinuses, opening as they do on the uterine mucous membrane, favors the escape of blood when they are torn across; and it is from them, possibly to some extent also from the uterine arteries, that the blood comes, just as in post-partum hemorrhage, when the whole, instead of a part, of the placental site is bared.

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[1] Edin. Med. Journ., Nov. 1872.

Causes of Hemorrhage.—Various explanations have been given of the causes of the hemorrhage. For long it was supposed to depend on the gradual expansion of the cervix during the latter months of pregnancy, which separated the abnormally placed placenta. It has been seen, however, that this shortening of the cervix is apparent only, and that the cervical canal is not taken up into the uterine cavity during gestation, or, at all events, only during the last week or so. This, therefore, cannot be admitted as an explanation of placental separation. Jacquemier proposed another theory, which has been adopted by Cazeaux. He maintains that during the first six months of utero-gestation the superior portion of the uterus is more especially developed, as shown by the pyriform shape of the fundus during that time; and that, as the placenta is usually attached in that situation, and then attains its maximum of development, its relations to its attachments are undisturbed. During the last three months of pregnancy, on the contrary, the lower segment of the uterus develops more than the upper, while the placenta remains nearly stationary in size; the inevitable result being a loss of proportion between the cervix and the placenta, and the detachment of the latter. There are various objections which can be brought against this theory; the most important being that there is no evidence at all to show that the lower segment of the uterus does expand more in proportion than the upper during the latter months of pregnancy. Dr. Barnes's theory is based on the supposition that the loss of relation between the uterus and placenta is caused by excess of growth on the part of the placenta itself over that of the cervix, which is not adapted for its attachment. The placenta, on this theory, grows away from the site of its attachment, and hemorrhage results. It will be observed that neither this theory nor that propounded by Jacquemier is readily reconcilable with the fact that hemorrhage frequently does not begin until labor has commenced at term. Inasmuch as the loss of relation between the placenta and its attachments, which they both presuppose, must exist in every case of placenta prævia, hemorrhage should always occur during some part of the last three months of pregnancy. Dr. Matthews Duncan[1] has recently investigated the whole subject at length, and maintains that the hemorrhages are accidental, not unavoidable, being due to precisely similar causes to those which give rise to the occasional hemorrhages when the placenta is normally placed. The abnormal situation of the placenta, of course, renders these causes more apt to operate; but in their action he believes them to be precisely similar to those of accidental hemorrhage, properly so called. Separation of the placenta from expansion of the cervix he believes to be the cause of hemorrhage after labor has begun, and then it may strictly be called unavoidable; but hemorrhage is comparatively seldom so produced during the continuance of pregnancy. "There are," says Duncan, "four ways in which this kind of hemorrhage may occur:

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[1] Edin. Med. Journ., Nov. 1873, and Brit. Med. Journ., Nov. 1873.

"1. By the rupture of a utero-placental vessel at or above the internal os uteri.

"2. By the rupture of a marginal utero-placental sinus within the area of spontaneous premature detachment, when the placenta is inserted not centrally or covering the internal os, but with a margin at or near the internal os.

"3. By partial separation of the placenta from accidental causes, such as a jerk or fall.

"4. By partial separation of the placenta, the consequence of uterine pains producing a small amount of dilatation of the internal os. Such cases may be otherwise described as instances of miscarriage commencing, but arrested at a very early stage."

I see no reason to doubt the possibility of hemorrhage being due, in many cases, to the first three causes, and in its production it would strictly resemble accidental hemorrhage. The fourth heading refers the hemorrhage to partial separation in consequence of commencing dilatation of the cervix, but it explains the dilatation by the supposition of commencing miscarriage. This latter hypothesis seems to be as needless as those which presuppose a want of relation between the placenta and its attachments. We know that, quite independently of commencing miscarriage, uterine contractions are constantly occurring during the continuance of pregnancy. This has been conclusively shown by Braxton Hicks, and any one can readily ascertain the fact by keeping his hand for a few minutes on a pregnant uterus. There is no reason to suppose that these contractions do not affect the cervical as well as the fundal portions of the uterus; and it is easy to understand how, in cases in which the placenta is situated partially or entirely over the os, one or more stronger contractions than usual may, at any moment, produce laceration of the placental attachments in that neighborhood.

Pathological Changes in the Placenta.—In cases of placenta prævia a careful examination of the placenta may show pathological changes at the site of separation, such as have been described by Gendrin, Simpson, and other writers. These probably consist of thrombosis in the placental cotyledons, with effused blood-clots, variously altered and discolored, according to the lapse of time since separation took place. Authors have also described changes as occurring in the portion of the placenta overlying the os uteri, whether separation has occurred or not. There appears to be a tendency to atrophy of the placental structure in this situation, as well as to changes of form, such as complete or partial separation into two lobes, the junction of which overlies the os uteri.[1]

The history of delivery, if left to nature, is specially worthy of study as guiding to proper rules of treatment in these anxious cases. It sometimes happens, when the pains are very strong and the delivery rapid, that labor is completed without any hemorrhage of consequence.

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[1] Sinelius, Arch. Gén. de Méd., vol. ii., 1861.

"Although," says Cazeaux, "hemorrhage is usually considered to be inevitable under such circumstances, yet it may not appear even during the labor, and the dilatation of the os uteri may be effected without the loss of a drop of blood." Again, Simpson conclusively showed, by a large number of cases, that when the placenta was expelled before the birth of the child, all hemorrhage ceased.

Barnes's theory of placenta prævia, which has been pretty generally adopted, explains satisfactorily both these classes of cases.

He describes the uterine cavity as divisible into three zones or divisions. When the placenta is situated in the upper or middle of these zones, no separation or hemorrhage need occur during labor. When, however, it is situated partially or entirely in the lower or cervical zone, the expansion of the cervix during labor must produce more or less separation, and consequent loss of blood. As soon as the previous portion of the placenta is sufficiently separated, provided contraction of the uterine tissue be present to seal up the mouths of the vessels, hemorrhage no longer takes place. The placenta may not be entirely detached, but no farther hemorrhage occurs, in consequence of the remaining portion being engrafted on the uterus beyond the region of unsafe attachment.

In the former, then, of these classes of cases, the absence of hemorrhage is explained, on this theory, by the pains being sufficiently rapid and strong to complete the separation of the placental attachment from the lower cervical zone before flooding had taken place; in the latter, it ceases, not necessarily because the entire placenta is expelled, but because of its detachment from the area of dangerous implantation.

The amount of cervical expansion required for this purpose varies in different cases. Dr. Duncan[1] has studied this point accurately, and estimates the limit of the spontaneous detaching area to be a circle of 4½ inches' diameter, and that after the cervix has expanded to that extent no further separation of the placenta or hemorrhage takes place. To admit of the passage of a full-sized head, Barnes estimates that expansion to about a circle of 6 inches is necessary; on the other hand, he has sometimes observed "that the hemorrhage has completely stopped when the os uteri had opened to the size of the rim of a wineglass, or even less."

It will be seen, then, that in this, as in every other form of puerperal hemorrhage, the tendency of uterine contraction is to check the hemorrhage; and that, provided the pains are sufficiently energetic, nature may be capable of stopping the flooding without artificial aid. It is but rarely, however, that she can be trusted for the purpose; and we shall presently see that these theoretical views have an important practical bearing on the subject of treatment.

The *prognosis* to both the mother and child is certainly grave in all cases of placenta prævia. Read, in his treatise on placenta prævia, estimates the maternal mortality, from the statistics of a large number of cases, as 1 in 4½ cases, and Churchill as 1 in 3. This is unquestionably too high an estimate, and based on statistics the accuracy of which cannot be relied on. The mortality will, of course, greatly depend on the treatment adopted. Doubtless, if cases were left to nature, the result would be quite as unfavorable as Read supposes. But, if properly managed, much more successful results may safely be anticipated. Out of 64 cases, recorded by Barnes, the deaths were 6, or 1 in $10\frac{2}{3}$. Under any circumstances, the risk to the mother must be considered to be very great. Churchill estimates that more than half the children are lost. The reasons for the great danger to the child are very obvious, subjected as it is to the risk of asphyxia from the loss of the maternal blood, and from its respiration being carried on during the continuance of labor, by a placenta which is only partially attached; many children also perish from prematurity, or from malpresentation.

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[1] Obst. Trans., vol. xv.

Treatment.—Whenever, in the latter months of pregnancy, a sudden hemorrhage occurs, the possibility of placenta prævia will naturally suggest itself; and by a careful vaginal examination, which under such circumstances should always be insisted on, the existence of this complication will generally be readily ascertained. It is seldom that the os is not sufficiently dilated to enable us to satisfy ourselves whether the placenta is presenting.

The first question that will arise is, are we not justified in temporizing, using means to check the hemorrhage, and allowing the pregnancy to continue? This is the course which has generally been recommended in works on midwifery. We are told to place the patient on a hard mattress, not to heat or overburden her with clothes, to keep her absolutely at rest, to have the room cool and well aired, to apply cold cloths to the vulva and lower part of the abdomen, to administer cold and acidulated drinks in abundance, and to prescribe acetate of lead and opium, or gallic acid, on account of their supposed hæmostatic effect. Of late years the judiciousness of these recommendations has been strongly contested. Not long ago an interesting discussion took place at the Obstetrical Society of London,[1] on a paper in which Dr. Greenhalgh advised the immediate induction of labor in all cases of placenta prævia. No less than six metropolitan teachers of midwifery took part in it; and, although they differed in details, they all agreed as to the unadvisability of allowing pregnancy to progress when the existence of placenta prævia had been distinctly ascertained. The reasons for this course are obvious and unanswerable. The labor, indeed, very often comes on of its own accord; but, should it not do so, the patient's life must be considered to be always in jeopardy until the case is terminated, for no one can be sure that most dangerous, or even fatal, flooding may not at any moment come on; and the nearer to term the patient is, the greater the risk to which she is subjected. Nor is the safety of the child likely to be increased by delay. Provided it has arrived at a viable age, the chances of its being born alive may be said to be greater if pregnancy be terminated at once, than if repeated floodings occur. I think, therefore, that it may be safely laid down as an axiom that no attempt should be made to prevent the termination of pregnancy, but that our treatment should rather contemplate its conclusion as soon as possible. An exception may, however, be made to this rule when the hemorrhage occurs for the first time before the seventh month of utero-gestation. The chances of the child surviving would then be very small, and if the hemorrhage be not alarming, as at that early period is likely to be the case, the measures indicated above may be employed, in the hope of carrying on the pregnancy until there is a prospect of the patient being delivered of a living child. But little benefit is likely to accrue from astringent drugs. Perfect rest in bed is more likely to be beneficial than anything else; and astringent vaginal pessaries, of matico or perchloride of iron, might be used with advantage as local hæmostatics.

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[1] Obst. Trans., vol. vi. p. 188.

Various Methods of Treatment.—When the period of pregnancy, or the urgency of the case, determines us to forego any attempt at temporizing, there are various plans of treatment to be considered. These are, chiefly: 1. *Puncture of the membranes.* 2. *Plugging the vagina.* 3. *Turning.* 4. *Partial or complete separation of the placenta.* It will be well to consider in detail the relative advantages of, and indications for, each of these. It is seldom, however, that we can trust to any one *per se;* in most cases two or more require to be used in combination.

1. *Puncture of the membranes* is recommended by Barnes as the first measure to be adopted in all cases of placenta prævia sufficient to cause anxiety. "It is," he says, "the most generally efficacious remedy, and it can always be applied." The primary object gained is the increase of uterine contraction, by the evacuation of the liquor amnii. Although the first effect of this may be to increase the flow of blood by further separation of the placenta, the flooding can be generally commanded by plugging, until the os is sufficiently dilated to permit the passage of the child. As a rule, there is no great difficulty in effecting the puncture, especially if the placental presentation be only partial. A quill, or other suitable contrivance, guided by the examining finger, is passed through the cervix and pushed through the membranes. In complete placenta prævia it may not be so easy to effect the evacuation of the liquor amnii; and, although many authorities advise the penetration of the substance of the placenta itself, I am inclined to think that it would be better to abandon the attempt, in such cases, and trust to other methods of treatment.

The objections which have been raised to puncture of the membranes are, chiefly, that it interferes with the gradual dilatation of the os, and renders the operation of turning much more difficult. The os is not, however, so regularly dilated by the bag of membranes in cases of placenta prævia as it is in ordinary labors. Moreover, the cervical tissues are generally relaxed by the hemorrhage, and dilatation is easily effected. Should we desire to dilate the os, preparatory to turning, we can readily do so by means of Barnes's bags, which act, at the same time, as an efficient plug. The objections, therefore, are not so weighty as they might have been before these artificial dilators were used. I am inclined, for these reasons, to agree with the recommendation that puncture of the membranes should be resorted to in all cases of placenta prævia.

2. *Plugging of the vagina*, or, still better, of the cavity of the cervix itself, is specially serviceable in cases in which the os is not sufficiently dilated to admit of turning, or of separation of the placenta, and in which the hemorrhage still continues after the evacuation of the liquor

amnii. By means of this contrivance the escape of blood is effectually controlled.

The best way of plugging is to introduce a sponge tent of sufficient size into the cervical canal, and to keep it *in situ* by a vaginal plug; the best material for the latter, and the method of introduction, are described under the head of abortion (p. 225). The sponge tent not only controls the hemorrhage more effectually than any other means, but is, at the same time, effecting dilatation of the cervix. If preferred, a Barnes's bag may be used for the same purpose. Any form of plug can only be used as a temporary expedient. It cannot be left in many hours, on account of the irritation produced, and of the fetor from accumulating vaginal discharges. As long as it is in position, we should carefully examine, from time to time, to see that no blood is oozing past it, which is very apt to occur.

While the plug is *in situ*, other modes of exciting uterine action may be very advantageously employed, such as a firm abdominal bandage, occasional friction over the uterus, and repeated doses of ergot. The last is specially recommended by Dr. Greenhalgh, who uses, at the same time, a plug formed of an oblong india-rubber ball, inflated with air and covered with spongio-piline.

On the removal of the plug we may find that considerable dilatation has taken place, perhaps to a sufficient extent to admit of labor being safely concluded by the natural efforts. In that case we shall find that, although the pains continue, no fresh hemorrhage occurs. Should it do so, it will be necessary to adopt further measures.

3. *Turning* has long been considered *the* remedy *par excellence* in placenta prævia; and it is of unquestionable value in suitable cases. Much harm, however, has been done when it has been practised before the os was sufficiently dilated to admit of the passage of the hand, or when the patient was so exhausted by previous hemorrhage as to be unable to bear the shock of the operation. The records of many fatal cases in the practice of those who taught, as did the large majority of the older writers, that turning at all risks was essential, conclusively prove this assertion.

It is most likely to prove serviceable when, either at first, or after the use of the tampon, the os is sufficiently dilated to admit the hand, and when the strength of the patient is not much enfeebled. If she have a small, feeble, and thready pulse, it is certainly inapplicable, unless all other methods of arresting the hemorrhage have failed. And, even then, it would be well to attempt to rally the patient from her exhausted state by stimulants, &c., before the operation is commenced.

Provided the placental presentation be partial, the operation can be performed without difficulty in the usual way. In central implantation the passage of the hand may give rise to some difficulty. Dr. Rigby recommends that it should be pushed through the substance of the placenta until it reaches the uterine cavity. It is hardly possible to conceive how this could be done without completely detaching the placenta, and still less to understand how the fœtus could be dragged through the aperture thus made. It will be far better to pass the hand by the border of the placenta, separating it as we do so; and, if we can ascertain to which side of the cervix it is least attached, that should be chosen for the purpose. In all cases in which it is possible, turning by the bi-polar method should be preferred. In cases of placenta prævia especially it offers many advantages. The operation can be sooner performed; complete dilatation of the os is not so necessary; and it involves less bruising of the cervix, which is likely to be specially dangerous. When once a foot has been brought within the os, the delivery need not be hurried. The foot forms a plug, which effectually prevents all further loss; and we may then safely wait until we can excite uterine contraction, and terminate the labor with safety. Fortunately, the relaxation of the uterus, which is so often present, facilitates this manner of performing version, and it can generally be successfully accomplished. Should the case be one which is otherwise suitable for turning, and the requisite amount of dilatation of the cervix not be present, the latter can generally be effected in the space of an hour or more (while at the same time a farther loss of blood is effectually prevented) by the use of Barnes's bags.

Entire separation of the placenta was originally recommended by Simpson, in his well-known paper on the subject. The reasons which induced him to recommend it have already been stated. It is a mistake to suppose, however, as is so often done, that he intended to recommend it in all cases alike. This supposition he always was careful to deny. He advised it especially—

1. When the child is dead.
2. When the child is not yet viable.
3. When the hemorrhage is great and the os uteri is not yet sufficiently dilated for safe turning. This was the state in 11 out of 35 cases (Lee).
4. When the pelvic passages are too small for safe and easy turning.
5. When the mother is too exhausted to bear turning.
6. When the evacuation of the liquor amnii fails.
7. When the uterus is too firmly contracted for turning.[1]

These are very much the cases in which all modern accoucheurs would exclude the operation of turning; and it was especially when that was unsuitable that Simpson advised extraction of the placenta. As his theory of the source of hemorrhage is now almost universally disbelieved, so has the practice based on it fallen into disuse, and it need not be discussed at length. It is very doubtful whether the complete separation and extraction of the placenta was a feasible operation; unquestionably it can be by no means so easy as Simpson's writings would lead us to suppose. The introduction of the hand far enough to remove the placenta in an exhausted patient would probably cause as much shock as the operation of turning itself; and another very formidable objection to the procedure is the almost certain death of the child if any time elapse between the separation of the placenta and the completion of delivery. The modification of this method, so strongly advocated by Barnes, is certainly much easier of application, and would appear to answer every purpose that Simpson's operation effected. It is impossible to describe it better than in Barnes's own words:[2]

"*The operation is this:* Pass one or two fingers as far as they will go through the os uteri, the hand being passed into the vagina if necessary; feeling the placenta, insinuate the finger between it and the uterine wall; sweep the finger round in a circle, so as to separate the placenta as far as the finger can reach; if you feel the edge of the placenta, where the membranes begin, tear open the membranes carefully, especially if these have not been previously ruptured; ascertain, if you can, what is the presentation of the child before withdrawing your hand. Commonly, some amount of retraction of the cervix takes place after the operation, and *often the hemorrhage ceases.*"

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[1] Selected Obstet. Works, p. 68.

[2] Obstet. Operations, 2d ed., p. 417.

It will be seen from what has been said that no one rule of practice can be definitively laid down for all cases of placenta prævia. Our treatment in each individual case must be guided by the particular conditions that are present; and, if only we bear in mind the natural history of the hemorrhage, we may confidently look to a favorable termination.

Summary of Rules for Treatment.—It may be useful, in conclusion, to recapitulate the rules which have been laid down for treatment, in the form of a series of propositions:

I. Before the child has reached a viable age, temporize, provided the hemorrhage be not excessive, until pregnancy has advanced sufficiently to afford a reasonable hope of saving the child. For this purpose the chief indication is absolute rest in bed, to which other accessory means of preventing hemorrhage, such as cold, astringent pessaries, etc., may be added.

II. In hemorrhage occurring after the seventh month of utero-gestation, no attempt should be made to prolong the pregnancy.

III. In all cases in which it can be easily effected, the membranes should be ruptured. By this means uterine contractions are favored, and the bleeding vessels compressed.

IV. If the hemorrhage be stopped, the case may be left to nature. If flooding continue, and the os be not sufficiently dilated to admit of the labor being readily terminated by turning, the os and the vagina should be carefully plugged, while uterine contractions are farther promoted by abdominal bandages, uterine compression, and ergot. The plug must not be left in beyond a few hours.

V. If, on removal of the plug, the os be sufficiently expanded, and the general condition of the patient be good, the labor may be terminated by turning, the bi-polar method being used if possible. If the os be not open enough, it may be advantageously dilated by a Barnes's bag, which also acts as a plug.

VI. Instead of, or before resorting to, turning, the placenta may be separated around the site of its attachment to the cervix. This practice is especially to be preferred when the patient is much exhausted, and in a condition unfavorable for bearing the shock of turning.

CHAPTER XIV.

HEMORRHAGE FROM SEPARATION OF A NORMALLY SITUATED PLACENTA.

THIS is the form of hemorrhage which is generally described in obstetric works as "*accidental*," in contradistinction to the "*unavoidable*" hemorrhage of placenta prævia. In discussing the latter, we have seen that the term "accidental" is one that is apt to mislead, and that the causation of the hemorrhage in placenta prævia is, in some cases at least, closely allied to that of the variety of hemorrhage we are now considering.

When, from any cause, separation of a normally situated placenta occurs before delivery, more or less blood is necessarily effused from the ruptured utero-placental vessels, and the subsequent course of the case may be twofold. 1. The effused blood, or at least some part of it, may find its way between the membranes and the decidua, and escape from the os uteri. This constitutes the typical "accidental" hemorrhage of authors. 2. The blood may fail to find a passage externally, and may collect internally, giving rise to very serious symptoms, and even proving fatal, before the true nature of the case is recognized. Cases of this kind are by no means so rare as the small amount of attention paid to them by authors might lead us to suppose; and, from the obscurity of the symptoms and difficulty of diagnosis, they merit special study. Dr. Goodell[1] has collected together no less than 106 instances in which this complication occurred.

Causes and Pathology.—The causes of placental separation may be very various. In a large number of cases it has followed an accident or exertion (such as slipping down stairs, stretching, lifting heavy weights, and the like), which has probably had the effect of lacerating some of the placental attachments. At other times it has occurred without such appreciable cause, and then it has been referred to some change in the uterus, such as a more than usually strong contraction producing separation, or some accidental determination of blood causing a slight extravasation between the placenta and the uterine wall, the irritation of which leads to contraction and farther detachment. We may safely assume that causes such as these, which are of daily occurrence in pregnancy, will not produce detachment except in women otherwise predisposed to it. It generally is met with in women who have borne many children, more especially in women of weakly constitution and impaired health, and rarely in primiparæ. Certain constitutional states probably predispose to it, such as albuminuria, or exaggerated anæmia; and, still more so, degenerations and diseases of the placenta itself.

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[1] Amer. Journ. of Obst., vol. ii.

This form of hemorrhage rarely occurs to an alarming extent until the latter months of pregnancy, often not until labor has commenced. The great size of the placental vessels in advanced pregnancy affords a reasonable explanation of this fact.

Symptoms and Diagnosis.—If, after separation of a portion of the placenta, the blood find its way between the membranes and the decidua, its escape per vaginam, even although in small amount, at once attracts attention, and reveals the nature of the accident. It is otherwise when we have to do with a case of concealed hemorrhage, the diagnosis of which is often a matter of difficulty. Then the blood probably at first collects between the uterus and the placenta. Sometimes marginal separation does not occur, and large blood-clots are formed in this situation, and retained there. More often, the margin of the placenta separates, and the blood collects between the membranes and the uterine wall, either towards the cervix, where the presenting part of the child may prevent its escape, or near the fundus. In the latter case especially, the coagula are apt to cause very painful stretching and distension of the uterus. The blood may also find its way into the amniotic cavity, but more frequently it does not do so; probably, as Goodell has pointed out, because "should the os uteri be closed, the membranes, however delicate, cannot, other things being equal, rupture any sooner from the uterine walls, for the sum of the resistance of the enclosed liquor amnii being equally distributed exactly counterbalances the sum of the pressure exerted by the effusion." This point is of some practical importance, because, after rupture of the membranes, the liquor amnii is frequently found untinged with blood, and this might lead us to suppose ourselves mistaken in our diagnosis, if this fact were not borne in mind.

Symptoms of Concealed Accidental Hemorrhage.—The most prominent symptoms in concealed internal hemorrhage are extreme collapse and exhaustion of the patient, for which no adequate cause can be assigned. These differ from those of ordinary syncope, with which they might be confounded, chiefly in their persistence and severity, and in the presence of the symptoms attending severe loss of blood, such as coldness and pallor of the surface, great restlessness and anxiety, rapid and sighing respiration, yawning, feeble, quick, and compressible pulse. When there is severe internal, with slight external, hemorrhage, we may be led to a proper diagnosis by observing that the constitutional symptoms are much more severe than the amount of external hemorrhage would account for. Uterine pain is generally present, of a tearing and stretching character, sometimes moderate in amount, more often severe, and occasionally amounting to intolerable anguish. It is often localized, and it, doubtless, depends on the distension of the uterus by the retained coagula. If the distension be marked, there may be an irregularity in the form of the uterus at the site of sanguineous effusion; but this will be difficult to make out, except in women with thin and unusually lax abdominal parietes. A rapid increase in the size of the uterus has been described as a sign by Cazeaux and others. It is not very likely that this will be appreciable towards the end of utero-gestation, when a very large amount of effusion would be necessary to produce it. At an earlier period of pregnancy, at or about the fifth month, I made it out very distinctly in a case in my own practice. It obviously must have occurred to an enormous extent in a case related by Chevalier, in which post-mortem Cæsarean section was performed under the impression that the pregnancy had advanced to term, but only a three months' fœtus was found, embedded in coagula which distended the uterus to the size of a nine months' gestation.[1] Labor pains may be entirely absent. If present, they are generally feeble, irregular, and inefficient.

Differential Diagnosis.—The only condition, besides ordinary syncope, that is likely to be confounded with this form of hemorrhage, is rupture of the uterus, to which the intense pain and profound collapse induce considerable resemblance. The latter rarely occurs until after labor has been some time in progress, and after the escape of the liquor amnii; whereas hemorrhage usually occurs either before labor has commenced, or at an early stage. The recession of the presentation, and the escape of the fœtus into the abdominal cavity, in cases of rupture, will further aid in establishing the diagnosis.

The *prognosis*, when blood escapes externally, is, on the whole, not unfavorable. The nature of the case is apparent, and remedial measures are generally adopted sufficiently early to prevent serious mischief. It is different with the concealed form, in which the mortality is very great. Out of Goodell's 106 cases, no less than 54 mothers died. This excessive death-rate is, no doubt, partly due to the fact that extreme prostration so often occurs before the existence of hemorrhage is suspected, and partly to the accident generally happening in women of weakly and diseased constitution. The prognosis to the child is still more grave. Out of 107 children, only 6 were born alive. The almost certain death of the child may be explained by the fact that when blood collects between the uterus and the placenta the fœtal portion of the latter is probably lacerated, and the child then also dies from hemorrhage.

Treatment.—In this, as in all other forms of puerperal hemorrhage, the great hæmostatic is uterine contraction; and that we must try to encourage by all possible means. The first thing to be done, whether the hemorrhage be apparent or concealed, is to rupture the membranes. If the loss of blood be only slight, this may suffice to control it, and the case may then be left to nature. A firm abdominal binder should, however, be applied to prevent any risk of blood collecting internally, as there is nothing to prevent its filling the uterine cavity after the membranes are ruptured. Contraction may be further advantageously solicited by uterine compression, and by the administration of full doses of ergot. If hemorrhage continue, or if we have any reason to suspect concealed hemorrhage, the sooner the uterus is emptied the better. If the os be sufficiently dilated, the best practice will be to turn without further delay, using the bi-polar method if possible. If the os be not open enough, a Barnes's bag should be introduced, while firm pressure is kept up to prevent uterine accumulation. Should the collapsed condition of the patient be very marked, the mere shock of the operation might turn the scale against her. Under such circumstances, it may be better practice to delay further procedure until, by the administration of stimulants, warmth, &c., we have succeeded in producing some amount of reaction, keeping up, in the mean while, firm pressure on the uterus. Should the head be low down in the pelvis, it may be easier to complete labor by means of the forceps.

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[1] Journ. de Méd. Clin. et Pharmac., vol. xxi. p. 363.

CHAPTER XV.

HEMORRHAGE AFTER DELIVERY.

HEMORRHAGE during, or shortly after, the third stage of labor is well known to be one of the most trying and dangerous accidents connected with parturition. Its sudden and unexpected occurrence just after the labor appears to be happily terminated, and its alarming effect on the patient, who is often placed in the utmost danger in a few moments, tax the presence of mind and the resources of the practitioner to the utmost, and render it an imperative duty on every one who practises midwifery to make himself thoroughly acquainted with its causes and preventive and curative treatment. There is no emergency in obstetrics which leaves less time for reflection and consultation, and the life of the patient will often depend on the prompt and immediate action of the medical attendant.

Frequency of Post-partum Hemorrhage.—Post-partum hemorrhage is one of the most frequent complications of delivery. I do not know of any statistics which enable us to judge with accuracy of its frequency, but I believe it to be an unquestionable fact that, especially in the upper ranks of society, it is very common indeed. This is probably due to the effects of civilization, and to the mode of life of patients of that class, whose whole surroundings tend to produce a lax habit of body which favors uterine inertia, the principal cause of post-partum hemorrhage.

Fortunately, it is, to a great extent, a preventible accident. I believe this fact cannot be too strongly impressed on the practitioner. If the third stage of labor be properly conducted, if every case be treated, as every case ought to be, as if hemorrhage were impending, it would be much more infrequent than it is. It is a curious fact that post-partum hemorrhage is much more common in the practice of some medical men than in that of others; the reason being, that those who meet with it often are careless in their management of their patients immediately after the birth of the child. That is just the time when the assistance of a properly qualified practitioner is of value, much more so than before the second stage of labor is concluded: hence, when I hear that a medical man is constantly meeting with severe post-partum hemorrhage, I hold myself justified "*ipso facto*" in inferring that he does not know, or does not practise, the proper mode of managing the third stage of labor.

Causes.—The placenta, as we have seen, is separated by the last pains, and the blood, which in greater or less quantity accompanies the fœtus, probably comes from the utero-placental vessels which are then lacerated. Almost immediately afterwards the uterus contracts firmly, and, in a typical labor, assumes the hard cricket-ball form which is so comforting to the accoucheur to feel. The result is the compression of all the vascular trunks which ramify in its walls, both arteries and veins, and thus the flow of blood through them is prevented. By referring to what has been said as to the anatomy of the muscular fibres of the gravid uterus, especially at the placental site (p. 52), it will be seen how admirably they are adapted for this purpose. The arrangement of the vessels themselves favors the hæmostatic action of uterine contraction. The large venous sinuses are placed in layers, one above the other, in the thickness of the uterine walls, and they anastomose freely. When the superimposed layers communicate with those immediately below them, the junction is by a falciform or semilunar opening in the floor of the vessel nearest the external surface of the uterus. Within the margins of this aperture there are muscular fibres, the contraction of which probably tends to prevent retrogression of blood from one layer of vessels into the other. The venous sinuses themselves are of a flattened form, and they are intimately attached to the muscular tissues. It is obvious, then, that these anatomical arrangements are eminently adapted to facilitate the closure of the vessels. They are, however, large, and are destitute of valves; and if contraction be absent, or if it be partial and irregular, it is equally easy to understand why blood should pour forth in the appalling amount which is sometimes observed.

If uterine action be firm, regular, and continuous, the vessels must be sealed up, and hemorrhage effectually prevented. This fact has been doubted by many authorities. Gooch was the first to describe what he called "a peculiar form of hemorrhage" accompanying a contracted womb; and similar observations have been made by other writers, such as Velpeau, Rigby, and Gendrin. Simpson says, on this point, that strong uterine contractions "are not probably so essential a part in the mechanism of the prevention of hemorrhage from the open orifices of the uterine veins as we might *a priori* suppose."[1] With regard to Gooch's cases, it has been pointed out that his own description proves that, however firmly the uterus may have contracted immediately after the expulsion of the child, it must have subsequently relaxed, for he passed his hand into it to remove retained clots—a manœuvre which he could not have practised had tonic contraction been present. Barnes suggests that in some of these cases the hemorrhage came from a laceration of the cervix. Of course, blood may readily escape from a mechanical injury of this kind, although the uterus itself be in a satisfactory state of contraction; and the possibility of this occurrence should always be borne in mind.

[1] Selected Obstet. Works, p. 234.

Although, then, we may admit that post-partum hemorrhage is incompatible with persistent contraction of the uterus, it by no means follows that the converse is true. On the contrary, it is not uncommon to meet with cases in which the uterus is large and apparently quite flaccid, and in which there is no loss of blood. Alternate relaxation and contraction of the uterus after delivery are also of constant occurrence, and yet hemorrhage, during the relaxation, does not take place. The explanation no doubt is that immediately after the birth of the child there was sufficient contraction to prevent hemorrhage, and that during its continuance coagula formed in the mouths of the uterine sinuses, by which they were sufficiently occluded to prevent any loss when subsequent relaxation occurred.

In all probability, both uterine contraction and thrombosis are in operation in ordinary cases; and we shall presently see that all the means employed in the treatment of post-partum hemorrhage act by producing one or other of them.

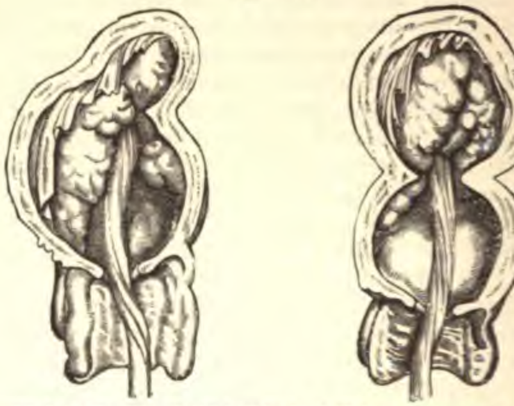
Secondary Causes of Hemorrhage.—Uterine inertia after labor, then, may be regarded as the one great primary cause of post-partum hemorrhage; but there are various secondary causes which tend to produce it, one of the most frequent of which is exhaustion following a protracted labor. The uterus gets worn out by its efforts, and when the fœtus is expelled it remains in a relaxed state, and hemorrhage results. Overdistension of the uterus acts in the same way. Hence hemorrhage is very frequently met with when there has been an excessive amount of liquor amnii, or in multiple pregnancies. One of the worst cases I ever met with was after the birth of triplets, the uterus having been of an enormous size. Rapid emptying of the uterus, during which there has not been sufficient time for complete separation of the placenta, often tends to the same result. This is the reason why hemorrhage so frequently follows forceps delivery, especially if the operation have been unduly hurried; and it is one of the chief dangers in what are termed "precipitate labors." The general condition of the patient may also strongly predispose to it. Thus, it is more often met with in women who have borne families, especially if they be weakly in constitution, comparatively seldom in primiparæ; and for the same reason that after-pains are most common in the former, namely, that the uterus, weakened by frequent child-bearing, contracts inefficiently. The experience of practitioners in the tropics shows that European women, debilitated by the relaxing effects of warm climates, are peculiarly prone to it, and it forms one of the chief dangers of child-birth amongst the English ladies in India.

Irregular Uterine Contraction.—Another important cause of post-partum hemorrhage is partial and irregular contraction of the uterus. Part of the muscular tissue is firmly contracted, while another part is relaxed, and the latter very often the placental site. This has been especially dwelt on by Simpson. He says, "The morbid condition which is most frequently and earliest seen in connection with post-partum hemorrhage is a state of irregularity and want of equability in the contractile action of different parts of the uterus—and, it may be, in different planes of the muscular fibres—as marked by one or more points in the organ feeling hard and contracted, at the same time that other portions of the parietes are soft and relaxed."

One peculiar variety, which has been much dwelt on by writers, and is a prominent bugbear to obstetricians, is the so-called "*hour-glass contraction.*" This in reality seems to depend on spasmodic contraction of the internal os uteri, by means of which the placenta becomes encysted in the upper portion of the uterus, which is relaxed. On introducing the hand, it first passes through the lax cervical canal, until it comes to the closed internal os, with the umbilical cord passing through it, which has generally been supposed to be a circular contraction of a portion of the body of the uterus.

Encystment of the placenta, however, although more rarely, unquestionably takes place in a portion only of the body of the uterus (Fig. 134). Then, apparently, the placental site remains more or less paralyzed, with the placenta still attached, while the remainder of the body of the uterus contracts firmly, and thus encystment is produced.

FIG. 134.



IRREGULAR CONTRACTION OF THE UTERUS, WITH ENCYSTMENT OF THE PLACENTA.

Causes of Irregular Contractions.—These irregular contractions of the uterus are by no means so common as our older authors supposed. When they do occur I believe them almost invariably to depend on defective management of the third stage of labor. "The most frequent cause," says Rigby,[1] "is from over-anxiety to remove the placenta; the cord is frequently pulled at, and at length the os uteri is excited to contract." While this is being done, no attempts are probably being made to excite the fundus to proper action, and therefore the hour-glass contraction is established. Duncan says of this condition, "Hour-glass contraction cannot exist unless the parts above the contraction are in a state of inertia; were the higher parts of the uterus even in moderate action, the hour-glass contraction would soon be overcome."[2] If placental expression were always employed, if it were the rule to effect the expulsion of the placenta by a *vis a tergo*, instead of extracting by a *vis a* tion to say, is pouring from the patient. If now the hand be placed on the abdomen, we shall miss the hard round ball of the contracted uterus, which will be found soft and flabby, or we may even be unable to make out its contour at all. If the hemorrhage be slight, or if we succeed in controlling it at once, no serious consequences follow; but if it be excessive, or if we fail to check it, the gravest results ensue.

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[1] Rigby's Midwifery, p. 225.

[2] Researches in Obstetrics, p. 389.

Exhaustion in Extreme Cases.—There are few sights more appalling to witness than one of the worst cases of post-partum hemorrhage. The pulse becomes rapidly affected, and may be reduced to a mere thread, or it may become entirely imperceptible. Syncope often comes on, not in itself always an unfavorable occurrence, as it tends to promote thrombosis in the venous sinuses. Or, short of actual syncope, there may be a feeling of intense debility and faintness. Extreme restlessness soon supervenes, the patient throws herself about the bed, tossing her arms wildly above her head; respiration becomes gasping and sighing, the "besoin de respirer" is acutely felt, and the patient cries out for more air; the skin becomes deadly cold, and covered with profuse perspiration; if the hemorrhage continue unchecked, we next may have complete loss of vision, jactitation, convulsions, and death.

Formidable as such symptoms are, it is satisfactory to know that recovery often takes place, even when the powers of life seem reduced to the lowest ebb. If we can check the hemorrhage while there is still some power of reaction left, however slight, we may not unreasonably hope for eventual recovery. The constitution, however, may have received a severe shock, and it may be months, or even years, before the patient recovers from the effects of only a few minutes' hemorrhage. A death-like pallor frequently follows these excessive losses, and the patient often remains blanched and exsanguine for a long time.

The *preventive treatment* of post-partum hemorrhage should be carefully practised in every case of labor, however normal. If the practitioner make a habit of never removing his hand from the uterus after the birth of the child until the placenta is expelled, and of keeping up continuous uterine contraction for at least half an hour after delivery is completed, not necessarily by friction on the fundus, but by simply grasping the contracted womb with the palm of the hand and preventing its undue relaxation, cases of post-partum flooding will seldom be met with. As a rule, we should, I think, not apply the binder until at least that time has elapsed. The binder is an effective means of keeping up, but not of producing, contraction, and it should never be trusted to for the latter purpose. If it be put on too soon, the uterus may relax under it, and become filled with clots without the practitioner knowing anything about it; whereas this cannot possibly take place as long as the uterine globe is held in the hollow of the hand. I have seen more than one serious case of concealed hemorrhage result from the too common habit of putting on the binder immediately after the removal of the placenta. I believe also, as I have formerly said, that it is thoroughly good practice to administer a full dose of the liquid extract of ergot in all cases after the placenta has been expelled, to ensure persistent contraction, and to lessen the chances of blood-clots being retained in utero.

These are the precautions which should be used in all cases alike; but when we have reason to fear, from the history of previous labors, or other cause, the occurrence of hemorrhage, special care should be taken. The ergot should be given before the birth of the child, when the presentation is so far advanced that we estimate that labor will be concluded in from ten to twenty minutes, as we can hardly expect the drug to produce any effect in less time. Particular attention, moreover, should then be paid to the state of the uterus. Every means should be taken to ensure regular and strong contraction, and it is advisable to rupture the membranes early, as soon as the os is dilated or dilatable, to ensure stronger uterine action. If any tendency to relaxation occur after delivery, a piece of ice should be passed into the vagina, or even into the uterine cavity itself. Should coagula collect in the uterus, they may be readily expelled by firm pressure on the fundus, and the finger should be passed occasionally up to the cervix, and any which are felt there should be gently picked away.

We should be specially on our guard in all cases in which the pulse does not fall after delivery. If it beat at 100 or more some ten minutes or a quarter of an hour after the birth of the child, hemorrhage not unfrequently follows; and hence it is a good practical rule, which may save much trouble, that a patient should never be left unless the pulse has fallen to its natural standard.

Curative Treatment.—As there are only two means which nature adopts in the prevention of post-partum hemorrhage, so the remedial measures also may be divided into two classes. 1. Those which act by the production of uterine contraction. 2. Those which act by producing thrombosis in the vessels. Of these the first are the most commonly used; and it is only in the worst cases, in which they have been assiduously tried and have failed, that we resort to those coming under the second heading.

Uterine Pressure.—The patient should be placed on her back, in which position we can more readily command the uterus, as well as attend to her general state. If the uterus be found relaxed and full of clots, by firmly grasping it in the hand contraction may be evoked, its contents expelled, and further hemorrhage at once arrested. Should this, fortunately, be the case, we must keep up contraction by gently kneading the uterus, until we are satisfied that undue relaxation will not recur. The powerful influence of friction in promoting contraction cannot be doubted, and nothing will replace it; no doubt it is fatiguing, but as long as it is effectual it must be kept up. No roughness should be used, as we might produce subsequent injury; but it is quite possible to use considerable pressure without any violence.

Another method of applying uterine pressure has been very strongly advocated by Dr. Hamilton, of Falkirk, and it may be serviceable where there is a constant draining from the uterus, and a capacious pelvis. It consists in passing the fingers of the right hand high up in the posterior cul-de-sac of the vagina, so as to reach the posterior surface of the uterus, while counter-pressure is exercised by the left hand through the abdomen. The anterior and posterior walls of the uterus are thus closely pressed together.

During the time that pressure is being applied, attention can be paid to general treatment; and in giving his directions to the bystanders the practitioner should be calm and collected, avoiding all hurry and excitement. A full dose of ergot should be administered, and if one have already been given it should be repeated. We cannot, however, look upon ergot as anything but a useful accessory, and it is one which requires considerable time to operate.

Stimulants.—The sudden flow will probably have produced exhaustion and a tendency to syncope, and the administration of stimulants will be necessary. The amount must be regulated by the state of the pulse, and the degree of exhaustion. There is no more absurd mistake, however, than implicitly relying on the brandy-bottle to check post-partum hemorrhage. In the worst cases absorption is in abeyance, and brandy may be poured down in abundance, the practitioner believing that he is rousing his patient, while he is, in fact, merely filling the stomach with a quantity of fluid, which is eventually thrown up unaltered. I have more than once seen symptoms, produced from the over-free use of brandy in slight floodings, which were certainly not those of hemorrhage. I remember on one occasion being summoned by a practitioner, with a view to transfusion, to a patient who was said to be insensible and collapsed from hemorrhage. I found her, indeed, unconscious, but with a flushed face, a bounding pulse, a firmly-contracted uterus, and deep stertorous breathing. On inquiry I ascertained that she had taken an enormous quantity of brandy, which had brought on the coma of profound intoxication, while the hemorrhage had obviously never been excessive.

Fresh Air.—The windows should be thrown widely open, to allow a current of fresh cold air to circulate freely through the room. The pillows should be removed, the head kept low, and the patient should be assiduously fanned.

Emptying of the Uterus.—If bleeding continue, or if it commence before the placenta is expelled, the hand should be carefully and gently passed into the uterus, and its cavity cleared of its contents. The mere presence of the hand within the uterus is a powerful inciter of uterine action. When the placenta is retained, it is the more essential, as the hemorrhage cannot possibly be checked as long as the uterus is distended by it. During the operation the uterus should be supported by the left hand externally, and by using the two hands in concert the chances of injuring the textures are greatly lessened.

If the so-called "*hour-glass contraction*" be present, or if the placenta be morbidly adherent, the operation will be more difficult, and will require much judgment and care. The spasmodic contraction of the inner os in the former case may generally be overcome by gentle and continuous pressure of the fingers passed within the contraction, while the uterus is supported from without. By this means, too, further hemorrhage can in most cases be controlled until the spasm is sufficiently relaxed to admit of the passage of the hand.

Signs of Adherent Placenta.—There are no very reliable signs to indicate morbid adhesion of the placenta, previous to the introduction of the hand. The following are the symptoms as laid down by Barnes, any of which might, however, accompany non-detachment of the placenta, unaccompanied by adhesion: "You may suspect morbid adhesion, if there have been unusual difficulty in removing the placenta in previous labors; if, during the third stage, the uterus contracts at intervals firmly, each contraction being accompanied by blood, and yet, on following up the cord, you feel the placenta *in utero;* if on pulling on the cord, two fingers being pressed into the placenta at the root, you feel the placenta and uterus descend in one mass, a sense of dragging pain being elicited; if during a pain the uterine tumor does not present a globular form, but be more prominent than usual at the place of placental attachment."[1]

Treatment of Adherent Placenta.—The artificial removal of an adherent placenta is always a delicate and anxious operation, which, however carefully performed, must of necessity expose the patient to the risk of injury to uterine structures, and leaving behind portions of placental structure, which may give rise to secondary hemorrhage, or septicæmia. The cord will guide the hand to the site of attachment, and the fingers must be very gently insinuated between the lower edge of the placenta and the uterine wall; or, if a portion be already detached, we may commence to peel off the remainder at that spot. Supporting the uterus externally, we carefully pick off as much as possible, proceeding with the greatest caution, as it is by no means easy to distinguish between the placenta and the uterus. At the best it is far from easy to remove all, and it is wiser to separate only what we readily can, than to make too protracted efforts at complete detachment.

Excitement of Reflex Action.—Various means are used for exciting uterine contraction by reflex stimulation. Amongst the most important of these is the action of cold. In patients who are not too exhausted to respond to the stimulus applied, it is of extreme value. But, to be of use, it should be used intermittently, and not continuously. Pouring a stream of cold water from a height on the abdomen is a not uncommon, but bad, practice, as it deluges the patient and the bedding in water, which may afterwards act injuriously. Flapping the lower part of the abdomen with a wet towel is less objectionable. Ice can generally be obtained, and a piece should be introduced into the uterus. This is a very powerful hæmostatic, and often excites powerful action when other means fail. I constantly employ it, and have never seen any bad results follow. A large piece of ice may also be held over the fundus, and removed, and re-applied from time to time. Iced water may be injected into the rectum. A very powerful remedy is washing out the uterine cavity with a stream of cold water, by means of the vaginal pipe of a Higginson's syringe carried up to the fundus. All these remedies, however, depend for their good results on the fact of the patient being in a condition to respond to stimulus; and their too prolonged use, if they fail to excite contraction rapidly, will certainly prove injurious. Rigby used to look upon the application of the child to the breast as one of the most certain inciters of uterine action. It may be of service, after the immediate hemorrhage has been checked, in keeping up tonic contraction, and should therefore not be omitted; but we certainly cannot waste time in inducing the child to suck in the face of the actual emergency.

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[1] Obstetric Operations, p. 440.

The *state of the bladder* should always be looked to. The late Dr. Earle pointed out[1] that a distended bladder often prevents contraction, and to avoid the possibility of this the catheter should be passed.

Plugging of the vagina has often been used. It is only necessary to mention it for the purpose of insisting on its absolute inapplicability in all cases of post-partum hemorrhage; the only effect it could have would be to prevent the escape of blood externally, which might then collect to any extent in the cavity of the uterus.

Compression of the abdominal aorta is highly thought of by many Continental authorities, but is little known or practised in this country. It has been objected to by some on the theoretical ground that the hemorrhage is chiefly venous, and not arterial, and that it would only favor the reflux of venous blood into the vena cava. Cazeaux very justly points out that, on account of the close anatomical relations between the aorta and the vena cava, it is hardly possible to compress one vessel without the other. The backward flow of blood, therefore, through the vena cava may also be thus arrested. There is strong evidence in favor of the occasional utility of compression. Its chief recommendation is that it can be practised immediately, and by an assistant who can be shown how to apply the pressure. It is most likely to prove useful in sudden and severe hemorrhage, and, even if it only control the loss for a few moments, it gives us time to apply other methods of treatment. As a temporary expedient, therefore, it should be borne in mind, and adopted when necessary. It has the great advantage of supplementing, without superseding, other and more radical plans of treatment. The pressure is very easily applied, on account of the lax state of the abdominal walls. The artery can readily be felt pulsating above the fundus uteri, and can be compressed against the vertebræ by three or four fingers applied lengthways. Baudelocque, who was a strong advocate of this procedure, states that he has on several occasions controlled an otherwise intractable hemorrhage in this way, and that he on one occasion kept up compression for four consecutive hours. Cazeaux believes that compression of the aorta may have a farther advantageous effect in retaining the mass of the blood in the upper part of the body, and thus lessening the tendency to syncope and collapse. If an aortic tourniquet, such as is used for compressing the vessel in cases of aneurism, could be obtained, it might be used with advantage in serious cases.

Injection of Styptics.—Supposing all these means fail, and the uterus obstinately refuses to contract in spite of all our efforts—and, do what we may, cases of this kind will occur—the only other agent at our command is the application of a powerful styptic to the bleeding surface to produce thrombosis in the vessels. "The latter," says Dr. Ferguson,[2] alluding to this means of arresting hemorrhage, "appears to be the sole means of safety in those cases of intense flooding in which the uterus flaps about the hand like a wet towel. Incapable of contraction for hours, yet ceasing to ooze out a drop of blood, there is nothing apparently between life and death but a few soft coagula plugging up the sinuses." These form but a frail barrier indeed; but the experience of all who have used the injection of a solution of perchloride of iron in such cases proves that they are thoroughly effectual, and its introduction into practice is one of the greatest improvements in modern midwifery. Although this method of treating these obstinate cases is not new, since it was practised long ago in Germany, its adoption in this country is unquestionably due to the energetic recommendation of Dr. Barnes. Although the dangers of the practice have been strongly insisted on, and with a degree of acrimony that is to be regretted, no one has yet brought forward any cases in which its evil effects have been conclusively proved. Its extraordinary power, however, of instantly checking the most formidable hemorrhage has been demonstrated, by the unanimous testimony of all who have tried it. As it is not proposed by any one that this means of treatment should be employed until all methods of evoking contraction have failed, and as in cases of this kind the lives of the patients are of necessity imperilled, we should be fully justified in adopting it even if its possible injurious effects had been much more certainly proved. It is surely at any time justifiable to avoid a great and pressing peril by running a possible chance of a less one. Whenever, therefore, we have tried all the plans above indicated in vain, no time should be lost in resorting to this expedient. No practitioner should attend a case of midwifery without having the necessary styptic with him. The best and most easily obtainable form of using the remedy is the "liquor ferri perchloridi" of the London Pharmacopœia, which should be diluted for use with six times its bulk of water. This is certainly better than a weaker solution. The vaginal pipe of a Higginson's syringe, through which the solution has once or twice been pumped to exclude the air, is guided by the hand to the fundus uteri, and the fluid injected gently over the uterine surface. The loose and flabby mucous membrane is instantaneously felt to pucker up, all the blood with which the fluid comes in contact is coagulated, and the hemorrhage is immediately arrested. I think it is of importance to make sure that the uterus and vagina are emptied of clots before injection. In the only case in which I have seen any bad symptoms follow, this precaution had been neglected. The iron hardened all the coagula, which remained in utero, and septicæmia supervened; which, however, disappeared after the clots had been broken up and washed away by intra-uterine antiseptic injections. After we have resorted to this treatment, all further pressure on the uterus should be stopped. We must remember that we have now abandoned contraction as an hæmostatic, and are trusting to thrombosis, and that pressure might detach and lessen the coagula which are preventing the escape of blood.

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[1] Earle's Flooding after Delivery, p. 163.

[2] Preface to Gooch On Diseases of Women, p. xlii.

Other local astringents may be eventually found to be of use. Tincture of matico possibly might be serviceable, although I am not aware that it has been tried. Dupierris has advocated the use of tincture of iodine, and has recorded 24 cases in which he employed it, in all without accident and with a successful issue. But nothing seems likely to act so immediately, or so effectually, as the perchloride of iron.

Hemorrhage from Laceration.—A word may here be said as to the occasional dependence of hemorrhage after delivery on laceration of the cervix, or other accidental injury to the maternal soft parts. Duncan has narrated a case in which the bleeding came from a ruptured perinæum. If hemorrhage continue after the uterus is permanently contracted, a careful examination should be made to ascertain if any such injury exist. Most generally it will be found that the source of bleeding is the cervix, and the flow can be readily arrested by swabbing the injured textures with a sponge saturated in a solution of the perchloride.

The *secondary treatment* of post-partum hemorrhage is of importance. When reaction commences, a train of distressing symptoms often show themselves, such as intense and throbbing headache, great intolerance of light and sound, and general nervous prostration; and, when these have passed away, we have to deal with the more chronic effects of profuse loss of blood. Nothing is so valuable in relieving these symptoms as opium. It is the best restorative that can be employed; but it must be administered in larger doses than usual. Thirty to forty drops of Battley's solution should be given, by the mouth, or in an enema. At the same time, the patient should be kept perfectly still and quiet, in a darkened room, and the visits of anxious friends strictly forbidden. Strong beef essence, or gravy soup, milk, or eggs beaten up with milk, and similar easily absorbed articles of diet, should be given frequently, and in small quantities at a time. Stimulants will be required according to the state of the patient, such as warm brandy-and-water, port wine, &c. Rest in bed should be insisted on, and continued much beyond the usual time. Eventually the remedies which act by promoting the formation of blood, such as the various preparations of iron, will be found useful, and may be required for a length of time.

Transfusion.—Under the head of transfusion I have separately treated the application of that last resource in those desperate cases in which the loss of blood has been so excessive as to leave no other hope.

Secondary Post-partum Hemorrhage.—In the majority of cases, if a few hours have elapsed after delivery without hemorrhage, we may consider the patient safe from the accident. It is by no means very rare, however, to meet with even profuse losses of blood coming on in the course of convalescence, at a time varying from a few hours, or days, up to several weeks after delivery. These cases are described as examples of "*secondary hemorrhage*," and they have not received at all an adequate amount of attention from obstetric writers, inasmuch as they often give rise to very serious, and even fatal, results, and are always somewhat obscure in their etiology, and difficult to treat. We owe almost all our knowledge of this condition to an excellent paper by Dr. McClintock, of Dublin, who has collected characteristic examples from the writings of various authors, and accurately described the causes which are most apt to produce it.

Profuse Lochial Discharge.—We must, in the first place, distinguish between true secondary hemorrhage and profuse lochial discharge continued for a longer time than usual. The latter is not a very uncommon occurrence, and is generally met with in cases in which involution of the uterus has been checked; as by too early exertion, general debility, and the like. The amount of the lochial discharge varies in different women. In some patients it habitually continues during the whole puerperal month, and even longer, but not to an extent which justifies us in including it under the head of hemorrhage. In such cases prolonged rest, avoidance of the erect posture, occasional small doses of ergot, and, it may be, after the lapse of some weeks, astringent injections of oak bark, or alum, will be all that is necessary in the way of treatment.

True secondary hemorrhage is often sudden in its appearance and serious in its effects. McClintock mentions 6 fatal cases, and Mr. Bassett, of Birmingham,[1] has recorded 13 examples which came under his own observation, 2 of which ended fatally.

The *causes* may be either constitutional, or some local condition of the uterus itself.

Among the former are such as produce a disturbance of the vascular system of the body generally, or of the uterine vessels in particular. The state of the uterine sinuses, and the slight barrier which the thrombi formed in them offer to the escape of blood, readily explain the fact of any sudden vascular congestion producing hemorrhage. Thus, mental emotions, the sudden assumption of the erect posture, any undue exertion, the incautious use of stimulants, loaded condition of the bowels, or sexual intercourse shortly after delivery, may act in this way. McClintock records the case of a lady in whom very profuse hemorrhage occurred on the twelfth day after labor, when sitting up for the first time. Feeling faint after suckling, the nurse gave her some brandy, whereupon a gush of blood ensued, "deluging all the bed-clothes and penetrating through the mattress so as to form a pool on the floor." Here the erect position, the exquisite pain caused by nursing, and the stimulating drink, all concurred to excite the hemorrhage. In another instance the flooding was traced to excitement produced by the sudden return of an old lover on the eighth day after labor. Moreau especially dwells on the influence of local congestion produced by a loaded condition of the rectum. Constitutional affections producing general debility, and an impoverished state of the blood, probably also may have the same effect. Blot specially mentions albuminuria as one of these, and Saboia states that in Brazil secondary hemorrhage is a common symptom of miasmatic poisoning, and can only be cured by change of air and the free use of quinine.[2]

Local Causes.—Local conditions seem, however, to be more frequent factors in the production of secondary hemorrhage. These may be generally classed under the following heads:

1. Irregular and inefficient contraction of the uterus.
2. Clots in the uterine cavity.
3. Portions of retained placenta or membranes.
4. Retroflexion of the uterus.
5. Laceration or inflammatory state of the cervix.
6. Thrombosis or hæmatocele of the cervix or vulva.

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[1] Brit. Med. Journ., 1872.

[2] Saboia, Traité des Accouchements, p. 819.

7. Inversion of the uterus.
8. Fibroid tumors or polypus of the uterus.

The first four of these need only now be considered, the others being described elsewhere.

Relaxation of the uterus and distension of its cavity by coagula may give rise to hemorrhage, although not so readily as immediately after delivery, for coagula of considerable size are often retained in utero for many days after labor. The uterus will be found larger than it ought to be, and tender on pressure. Usually the coagula are expelled with severe after-pains; but this may not take place, and hemorrhage may ensue several days after delivery. Or there may be only a relaxed state of the uterus without retained coagula. Bassett relates 4 cases traced to these causes, and several illustrations will be found in McClintock's paper. Portions of retained placenta or membranes are more frequent causes. The retention may be due to carelessness on the part of the practitioner, especially if he have removed the placenta by traction and failed to satisfy himself of its integrity. It may, however, often be due to circumstances entirely beyond his control; such as adherent placenta, which it is impossible to remove without leaving portions in utero, or more rarely placenta succenturia. In the latter case there is a small supplementary portion of placental tissue developed entirely separate from the general mass, and it may remain in utero without the practitioner having the least suspicion of its existence. Portions of the membranes are very apt to be left in utero. It is to prevent this that they should be twisted into a rope, and extracted very gently after expression of the placenta. Hemorrhage from these causes generally does not occur until at least a week after delivery, and it may not do so until a much longer time has elapsed. In 4 cases, recorded by Mr. Bassett, it commenced on the twelfth, tenth, fourteenth, and thirty-second day. It may come on suddenly and continue; or it may stop, and recur frequently at short intervals. In my experience, retention of portions of the placenta is very common after abortion, when adhesions are more generally met with than at term. In addition to the hemorrhage there is often a fetid discharge, due to decomposition of the retained portion, and possibly more or less marked septicæmic symptoms, which may aid in the diagnosis. The placenta or membranes may simply be lying loose as foreign bodies in the uterine cavity; or they may be organically attached to the uterine walls, when their removal will not be so easily effected.

Retroflexion.—Barnes has specially pointed out the influence of retroflexion of the uterus in producing secondary hemorrhage,[1] which seems to act by impeding the circulation at the point of flexion, and thus arresting the process of involution.

Treatment.—In every case in which secondary hemorrhage occurs to any extent, careful investigation into the possible causes of the attack, and an accurate vaginal examination, are imperatively required. If it be due to general and constitutional causes only, we must insist on the most absolute rest on a hard bed in a cool room, and on the absence of all causes of excitement. The liquid extract of ergot will be very generally useful in ʒj doses repeated every six hours. McClintock strongly recommends the tincture of Indian hemp, which may be advantageously combined with the ergot, in doses of 10 or 15 minims, suspended in mucilage. Astringent vaginal pessaries of matico or perchloride of iron may be used. Special attention should be paid to the state of the bowels, and, if the rectum be loaded, it should be emptied by enemata. In more chronic cases a mixture of ergot, sulphate of iron, and small doses of sulphate of magnesia will prove very serviceable. This is more likely to be effectual when the bleeding is of an atonic and passive character. McClintock also speaks strongly in favor of the application of a blister over the sacrum. When the hemorrhage is excessive, more effectual local treatment will be required. Cazeaux advises plugging of the vagina. Although this cannot be considered so dangerous as immediately after delivery, inasmuch as the uterus is not so likely to dilate above the plug, still it is certainly not entirely without risk of favoring concealed internal hemorrhage. If it be used at all, a firm abdominal pad should be applied, so as to compress the uterus; and the abdomen should be examined from time to time, to ensure against the possibility of uterine dilatation. With these precautions, the plug may prove of real value. In any case of really alarming hemorrhage I should be disposed rather to trust to the application of styptics to the uterine cavity. The injection of fluid in bulk, as after delivery, could not be safely practised, on account of the closure of the os and the contraction of the uterus. But there can be no objection to swabbing out the uterine cavity with a small piece of sponge attached to a handle and saturated in a solution of the perchloride of iron. There are few cases which will resist this treatment.

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[1] Obstetric Operations, p.

If we have reason to suspect retained placenta or membranes, or if the hemorrhage continue or recur after treatment, a careful exploration of the interior of the womb will be essential. On vaginal examination, we may possibly be able to feel a portion of the placenta protruding through the os, which can then be removed without difficulty. If the os be closed, it must be dilated with sponge or laminaria tents, or by a small-sized Barnes's bag, and the uterus can then be thoroughly explored. This ought to be done under chloroform, as it cannot be effectually accomplished without introducing the whole hand into the vagina, which necessarily causes much pain. If the placenta or membranes be loose in the uterine cavity, they may be removed at once; or, if they be organically attached, they may be carefully picked off. The uterus should at the same time, and as long as the os remains patulous, be thoroughly washed out with Condy's fluid and water, to diminish the risk of septicæmia.

Retroflexion can readily be detected by vaginal examination, and the treatment consists in careful reposition with the hand, and the application of a large-sized Hodge's pessary.

CHAPTER XVI.

RUPTURE OF THE UTERUS, ETC.

RUPTURE of the uterus is one of the most dangerous accidents of labor, so much so that until of late years it has been considered almost necessarily fatal, and beyond the reach of treatment. Fortunately, it is not of very frequent occurrence, although the published statistics vary so much that it is by no means easy to arrive at any conclusion on this point. The explanation is, no doubt, that many of the tables confound partial and comparatively unimportant lacerations of the cervix and vagina with rupture of the body and fundus. It is only in large lying-in institutions, where the results of cases are accurately recorded, that anything like reliable statistics can be gathered, for in private practice the occurrence of so lamentable an accident is likely to remain unpublished. To show the difference between the figures given by authorities, it may be stated that, while Burns calculates the proportion to be 1 in 940 labors, Ingleby fixes it as 1 in 1300 or 1400, Churchill as 1 in 1331, and Lehmann as 1 in 2433. Amongst the most recent writers on the subject is Dr. Jolly, of Paris, who has published an excellent thesis containing much valuable information.[1] He finds that out of 782,741 labors, 230 ruptures, excluding those of the vagina or cervix, occurred—that is, 1 in 3403.

Seat of Rupture.—Lacerations may occur in any part of the uterus, the fundus, the body, or the cervix. Those of the cervix are comparatively of small consequence, and occur, to a slight extent, in almost all first cases. Only those which involve the supra-vaginal portion of the cervix are of really serious import. Ruptures of the upper part of the uterus are much less frequent than of the portion near the cervix; partly, no doubt, because the fundus is beyond the reach of the mechanical causes to which the accident can, not unfrequently, be traced, and partly because the lower third of the organ is apt to be compressed between the presenting part and the bony pelvis. The site of placental insertion is said by Madame Lachapelle to be rarely involved in the rupture; but it does not always escape, as numerous recorded cases prove. The most frequent seat of rupture is near the junction of the body and neck, either anteriorly or posteriorly, opposite the sacrum, or behind the symphysis pubis, but it may occur at the sides of the lower segment of the uterus. In some cases the entire cervix has been torn away, and separated in the form of a ring.

The laceration may be partial or complete; the latter being the more common. It may happen that the muscular tissue alone is torn, the peritoneal coat remaining intact; or the converse may occur, and then the peritoneum is often fissured in various directions, the muscular coat being unimplicated. The extent of the injury is very variable; in some cases being only a comparatively slight tear, in others forming a large aperture, sufficiently extensive to allow the whole of the uterine contents to pass into the abdominal cavity. The direction of the laceration is as variable as the size, but it is more frequently vertical than either transverse or oblique. On post-mortem examination the edges of the tear will be found to be irregular and jagged; probably on account of the contraction of the muscular fibres, which are frequently softened, infiltrated with blood, and even gangrenous. Large quantities of extravasated blood will be found in the peritoneal cavity; such hemorrhage, indeed, being one of the most important sources of danger.

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[1] Rupture utérine pendant le Travail, Paris, 1873.

The causes are generally, and with great propriety, divided into *predisposing* and *exciting;* and the progress of modern research tends more and more to show the importance of the former, and to lead to the conclusion that the cause which leads to the laceration could only have operated because the tissue of the uterus was in a state predisposed to rupture, and that it would have had no such effect on a perfectly healthy organ. What these predisposing changes are, and how they operate, is yet far from being known; and the subject offers a fruitful field for pathological investigation.

It is generally believed that lacerations are more common in multiparæ than in primiparæ. Tyler Smith contends that this view is erroneous, and that ruptures are relatively as common in first as in subsequent labors. Statistics are by no means sufficiently accurate or extensive to justify a positive conclusion, but it is reasonable to suppose that the pathological changes, presently to be mentioned as predisposing to laceration, are more likely to be met with in women whose uteri have frequently undergone the alteration attendant on repeated pregnancies. Age seems to have considerable influence, as a large proportion of cases have occurred in women between thirty and forty years of age.

Alterations in the tissues of the uterus are probably of very great importance in predisposing to the accident; although our information on this point is far from accurate. Among these are morbid states of the muscular fibres, the result of blows or contusions during pregnancy; premature fatty degeneration of the muscular tissues, an anticipation, as it were, of the normal involution after delivery; fibroid tumors, or malignant infiltration of the uterine walls, which either produce a morbid state of the tissues, or act as an impediment to the expulsion of the uterine contents. The importance of such changes has been specially dwelt on by Murphy in this country, and by Lehmann in Germany, and it is impossible not to concede their probable influence in favoring laceration. It must be admitted, however, that, as yet, these views are founded more on reasonable hypothesis than on accurately observed pathological facts.

Another and very important class of predisposing causes are circumstances which lead to a want of proper proportion between the pelvis and the fœtus.

Deformity of the pelvis has long been known to be very frequently met with in cases in which the uterus has ruptured, and its importance can be seen from the fact that out of 19 cases, carefully recorded by Radford,[1] the pelvis was contracted in 11, or more than one-half. Radford makes the curious observation that ruptures seem more likely to occur when the deformity is only slight; and he explains this by supposing that in slight deformities the lower segment of the uterus engages in the brim, and is, therefore, much subjected to compression, while in extreme deformity the os and cervix uteri are always situated above the brim, the body and fundus of the uterus hanging down between the thighs of the mother. This explanation is reasonable; but it must not be forgotten that the rarity with which ruptured uterus is associated with extreme pelvic deformity may rather depend on the infrequency of such advanced degrees of contraction.

Amongst causes of disproportion depending on the fœtus are either malpresentation, in which the pains cannot effect expulsion, or undue size of the presenting part. In the latter way may be explained the observation that rupture is much more frequently met with male than with female children, on account, no doubt, of the larger size of the head in the former. The influence of intra-uterine hydrocephalus was first prominently pointed out by Sir James Simpson,[2] who states that out of 74 cases of intra-uterine hydrocephalus the uterus ruptured in 16. In all such cases of disproportion, whether referable to the pelvis or fœtus, rupture is produced in a twofold manner, either by the excessive and fruitless uterine contractions which are induced by the efforts of the organ to overcome the obstacle, or by the compression of the uterine tissue between the presenting part and the bony pelvis, leading to inflammation, softening, and even gangrene.

The proximate causes of rupture may be classed under two heads—*mechanical injury* and *excessive uterine contraction*. Under the former are placed those uncommon cases in which the uterus lacerates as the result of some injury in the latter months of pregnancy, such as blows, falls, and the like. Not so rare, unfortunately, are lacerations produced by unskilled attempts at delivery on the part of the medical attendant, such as by the hand during turning, or by the blades of the forceps. Many such cases are on record, in which the accoucheur has used force and violence, rather than skill, in his attempts to overcome an obstacle. That such unhappy results of ignorance are not so uncommon as they ought to be is proved by the figures of Jolly, who has collected 71 cases of rupture during podalic version, 37 caused by the forceps, 10 by the cephalotribe, and 30 during other operations, the precise nature of which is not stated.[3] The *modus operandi* of protracted and ineffectual uterine contractions, as a proximate cause of rupture, is sufficiently evident, and need not be dwelt on. It is necessary to allude, however, to the effect of ergot, incautiously administered, as a producing cause. There is abundant evidence that the injudicious exhibition of this drug has often been followed by laceration of the unduly stimulated uterine fibres. Thus, Trask, talking of the subject, says that Meigs had seen 3 cases, and Bedford 4, distinctly traceable to this cause. Jolly found that ergot had been administered largely in 33 cases in which rupture occurred.

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[1] Obst. Trans., vol. viii.

[2] Selected Obst. Works, p. 385.

[3] Op. cit., p. 38.

Symptoms.—Some have believed that the impending occurrence of rupture could frequently be ascertained by peculiar premonitory symptoms, such as excessive and acute crampy pains about the lower part of the abdomen, due, no doubt, to the compression of part of the uterine walls. These are far too indefinite to be relied on, and it is certain that the rupture generally takes place without any symptoms that would have afforded reasonable grounds for suspicion.

The symptoms are often so distinct and alarming as to leave no doubt as to the nature of the case; not unfrequently, however, especially if the laceration be partial, they are by no means so well marked, and the practitioner may be uncertain as to what has taken place. In the former class of cases a sudden excruciating pain is experienced in the abdomen, generally during the uterine contractions, accompanied by a feeling, on the part of the patient, of something having given way. In some cases this has been accompanied by an audible sound, which has been noticed by the bystanders. At the same time there is generally a considerable escape of blood from the vagina, and a prominent symptom is the sudden cessation of the previously strong pains. Alarming general symptoms soon develop, partly due to shock, partly to loss of blood, both external and internal. The face exhibits the greatest suffering, the skin becomes deadly cold and covered with a clammy sweat, and fainting, collapse, rapid feeble pulse, hurried breathing, vomiting, and all the usual signs of extreme exhaustion, quickly follow.

Abdominal palpation and vaginal examination both afford characteristic indications in well-marked cases. If the child, as often happens, have escaped entirely, or in great part, into the abdominal cavity, it may be readily felt through the abdominal walls; while in the former case the partially contracted uterus may be found separate from it in the form of a globular tumor, resembling the uterus after delivery. Per vaginam it may generally be ascertained that the presenting part has suddenly receded and can no longer be made out; or some other part of the fœtus may be found in its place. If the rupture be extensive, it may be appreciable on vaginal examination, and sometimes a loop of intestine may be found protruding through the tear. Other occasional symptoms have been recorded, such as an emphysematous state of the lower part of the abdomen, resulting from the entrance of air into the cellular tissue, or the formation of a sanguineous tumor in the hypogastrium or vagina. These are too uncommon, and too vague, to be of much diagnostic value.

Symptoms sometimes Obscure.—Unfortunately, the symptoms are by no means always so distinct, and cases occur in which most of the reliable indications of rupture, such as the sudden cessation of the pains, the external hemorrhage, and the retrocession of the presenting part, may be absent. In some cases, indeed, the symptoms have been so obscure that the real nature of the case has only been detected after death. It is rarely, however, that the occurrence of shock and prostration is not sufficiently distinct to arouse suspicion, even in the absence of the usual marked signs. In not a few cases distinct and regular contractions have gone on after laceration, and the child has even been born in the usual way. Of course, in such a case mistake is very possible. So can be seen from the fact that out of 19 cases, carefully recorded by Radford,[1] the pelvis was contracted in 11, or more than one-half. Radford makes the curious observation that ruptures seem more likely to occur when the deformity is only slight; and he explains this by supposing that in slight deformities the lower segment of the uterus engages in the brim, and is, therefore, much subjected to compression, while in extreme deformity the os and cervix uteri are always situated above the brim, the body and fundus of the uterus hanging down between the thighs of the mother. This explanation is reasonable; but it must not be forgotten that the rarity with which ruptured uterus is associated with extreme pelvic deformity may rather depend on the infrequency of such advanced degrees of contraction.

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[1] Obst. Trans., vol. viii.

[2] Selected Obst. Works, p. 385.

[3] Op. cit., p. 38.

the case, some slight amount of pelvic contraction, it may be preferable to perforate and apply the cephalotribe, so as to avoid any forcible attempts at extraction, which might unduly exhaust the already prostrate patient, and turn the scale against her. This will be the more allowable since the child is, as we have seen, almost always dead, and we might readily ascertain if it be so by auscultation.

Removal of the Placenta.—After delivery, extreme care must be taken in removing the placenta, and for this it will be necessary to introduce the hand. Fortunately, the placenta will generally be in the uterus; for, if the rent be not large enough for the child to pass through, it may be inferred that the placenta will not have done so either. If, unfortunately, it has escaped from the uterus, very gentle traction on the cord may bring it within reach of the hand, and so the passage of the hand through the tear to search for it will be avoided.

There can be but little doubt that, in the cases indicated, such is the simplest treatment, and that which affords the mother the best chance. Unfortunately, the cases in which the child remains entirely in utero are comparatively uncommon, and generally it will have escaped into the abdomen, along with much extravasated blood. The usual plan of treatment recommended, under such circumstances, is to pass the hand through the fissure (some have even recommended that it should be enlarged by incision if necessary), to seize the feet of the fœtus, to drag it back through the torn uterus, and then to re-introduce the hand to search for and remove the placenta. Imagine what occurs during the process. The hand gropes blindly among the abdominal viscera, the forcible dragging back of the fœtus necessarily tears the uterus more and more, and, above all, the extravasated blood remains as a foreign body in the peritoneal cavity, and necessarily gives rise to the most serious consequences. It is surely hardly a matter of surprise that there is scarcely a single case on record of recovery after this procedure.

Gastrotomy.—Of late years a strong feeling has existed that, whenever the child has entirely, or in great part, escaped into the abdominal cavity, the operation of gastrotomy affords the mother a far better chance of recovery; and it has now been performed in many cases with the most encouraging results. It is easy to see why the prospects of success are greater. The uterus being already torn, and the peritoneum opened, the only additional danger is the incision of the abdominal parietes, which gives us the opportunity of sponging out the peritoneal cavity, as in ovariotomy, and of removing all the extravasated blood, the retention of which so seriously adds to the dangers of the case. Another advantage is that, if the patient be excessively prostrate, the operation may be delayed until she has somewhat rallied from the effects of the shock, whereas delivery by the feet is generally resorted to as soon as the rupture is recognized, and when the patient is in the worst possible condition for interference of any kind.

Jolly has carefully tabulated the results of these various methods of treatment, and, making every allowance for the unavoidable errors of statistics, it seems beyond all question that the results of gastrotomy are so greatly superior to those of other plans, that I think its adoption may fairly be laid down as a rule whenever the fœtus is no longer within the uterine cavity.

COMPARATIVE RESULTS OF VARIOUS METHODS OF TREATMENT AFTER RUPTURE OF THE UTERUS.

Treatment.	No. of Cases.	Deaths.	Recoveries.	Per Cent. of Recoveries.
Expectation	144	142	2	1.45
Extraction *per vias naturales* . .	382	310	72	19
Gastrotomy	38	12	26	68.4

Of course this table will not justify the conclusion that 68 per cent. of the cases of ruptured uterus in which gastrotomy is performed will recover; but it may fairly be taken as proving that the chances of recovery are at least three or four times as great as when the more usual practice is adopted.

It is perhaps needless to say that the operation must be performed with the same minute care that has raised ovariotomy to its present pitch of perfection, and that especial attention should be paid to the sponging out of the peritoneum and the removal of foreign matters.

To recapitulate, I think what has been said justifies the following rules of treatment after rupture:

1. If the head or presenting part be above the brim, and the fœtus still in utero—forceps, turning, or cephalotripsy, according to circumstances.
2. If the head be in the pelvic cavity—forceps or cephalotripsy.
3. If the fœtus have wholly, or in great part, escaped into the abdominal cavity—gastrotomy.

General Treatment.—As to the general treatment little need be said, since in this we must be guided by general principles. The chief indication will be to remove shock and rally the patient by stimulants, &c., and to combat secondary results by opiates and other appropriate remedies.

Lacerations of the vagina occasionally take place, and in the great majority of cases they are produced by instruments, either from a want of care in their introduction, or from undue stretching of the vaginal walls during extraction with the forceps. Slight vaginal lacerations are probably much more common after forceps delivery than is generally believed to be the case. As a rule they are productive of no permanent injury; although it must not be forgotten that every breach of continuity increases the risk of subsequent septic absorption. When the laceration is sufficiently deep to tear through the recto-vaginal septum or the anterior vaginal wall, the passage of the urine or fæces is apt to prevent its edges uniting; then that most distressing condition, recto-vaginal or vesico-vaginal fistula, is established.

It must not be supposed that fistulæ are often the result of injury during operative interference. That is a common opinion both among the profession and the public, but a very erroneous one. In the vast majority of cases the fistulous opening is the consequence of a slough resulting from inflammation produced by long-continued pressure of the vaginal walls between the child's head and the bony pelvis, in cases in which the second stage has been allowed to go on too long. In most of these cases instruments were doubtless eventually used, and they get the blame of the accident; whereas the fault lay, not in their being employed, but rather in their not having been used soon enough to prevent the contusion and inflammation which ended in sloughing.

When vesico-vaginal fistulæ are the result of lacerations during labor, the urine must escape at once; but this is rarely the case. In the large majority of cases the urine does not pass per vaginam until more than a week after delivery, showing that a lapse of time is necessary for inflammatory action to lead to sloughing. In order to throw some light on these points, on which very erroneous views have been held, I have carefully examined the histories, from various sources, of 63 cases of vesico-vaginal fistula.

1st. In 20 no instruments were employed. Of these, there were in

labor under 24 hours	2
from 24 to 48 hours . . .	8[1]
" 48 to 70 " . . .	2
" 70 to 80 " . . .	7
80 hours and upwards . .	1
	20

Therefore out of these 20 cases one-half were certainly more than 48 hours in labor, and 6 of the remaining 10 were probably so also. In only 1 of them is the urine stated to have escaped per vaginam immediately after delivery. In 7 it is said to have done so within a week, and in the remainder after the seventh day.

2d. In 34 cases instruments were used, but there is no evidence of their having produced the accident. Of these, there were in labor

under 24 hours	2
from 24 to 48 hours . . .	8
" 48 to 72 " . . .	10
72 hours and upwards .	14
	34

The urine escaped within 24 hours in 2 cases only, within a week in 16, and after the seventh day in 15.

So that here again we have the history of unduly protracted delivery, 24 out of the 34 having been certainly more than 48 hours in labor.

3d. In 9 cases the histories show that the production of the fistula may fairly be ascribed to the unskilled use of instruments. Of these,

there were in labor under 24 hours . . .	7
from 24 to 48 " . . .	1
" 48 to 72 " . . .	1
	9

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[1] But of these in seven no precise time is stated. Six of them are marked *very tedious:* therefore they probably exceeded the limit.

The urine escaped at once in 7 cases, and in the remaining 2 after the seventh day.

These statistics seem to me to prove, in the clearest manner, that in the large majority of cases this unhappy accident may be directly traced to the bad practice of allowing labor to drag on many hours in the second stage without assistance, and not to premature instrumental interference.

As to the treatment of vaginal laceration little can be said. In the slighter cases vaginal injections of diluted Condy's fluid will be useful to lessen the risk of septic absorption; and the graver, when vesico-vaginal or recto-vaginal fistulæ have actually formed, are no longer within the domain of the obstetrician, but must be treated surgically at some future date.

CHAPTER XVII.

INVERSION OF THE UTERUS.

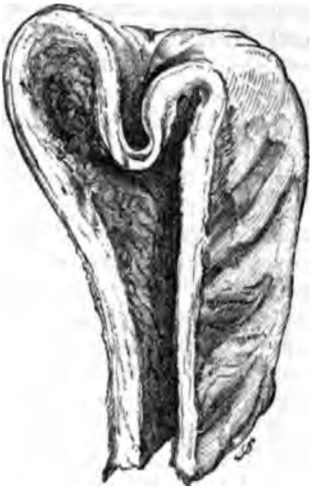
Inversion of the uterus shortly after the birth of the child is one of the most formidable accidents of parturition, leading to symptoms of the greatest urgency, not rarely proving fatal, and requiring prompt and skilful treatment. Hence it has obtained an unusual amount of attention, and there are few obstetric subjects which have been more carefully studied.

Fortunately, the accident is one of great rarity. It was only observed once in upwards of 190,800 deliveries at the Rotunda Hospital since its foundation in 1745; and many practitioners have conducted large midwifery practices for a lifetime without ever having witnessed a case. It is none the less needful, however, that we should be thoroughly acquainted with its natural history, and with the best means of dealing with the emergency when it arises.

Inversion of the uterus may be met with in both the acute and chronic form; that is to say, it may come under observation either immediately or shortly after its occurrence, or not until after a considerable lapse of time, when the involution following pregnancy has been completed. The latter falls more properly under the province of the gynæcologist, and involves the consideration of many points that would be out of place in a work on obstetrics. Here, therefore, the acute form of inversion alone is considered.

Description.—Inversion of the uterus consists essentially in the enlarged and empty uterus being turned inside out, either partially or entirely; and this may occur in various degrees, three of which are usually described and are practically useful to bear in mind. In the first and slightest form we have merely a cup-shaped depression of the fundus (Fig. 135); in the second the depression is greater, so that the inverted portion forms an intro-susception, as it were, and projects downwards through the os in the form of a round ball, not unlike the body of a polypus, for which, indeed, a careless observer might mistake it; and, thirdly, we have the complete variety, in which the whole organ is turned inside out as far as the cervix, and may even project beyond the vulva.

FIG. 135.



PARTIAL INVERSION OF THE FUNDUS.
(From a preparation in the museum of Guy's Hospital.)

The *symptoms* of inversion are generally very characteristic, although, when the amount of inversion is small, they may entirely escape observation. They are chiefly those of profound nervous shock, fainting, small, rapid, and feeble pulse, possibly convulsions and vomiting, and a cold, clammy skin. Occasionally severe abdominal pain, and a sensation of cramp and bearing down, are observed. Hemorrhage is a frequent accompaniment, sometimes to a very alarming extent, especially if the placenta be partially or entirely detached. The loss of blood depends to a great extent on the condition of the uterine parietes. If there be much contraction of the part that is not inverted, the intro-suscepted part may be sufficiently compressed to prevent any great loss. If the entire organ be in a state of relaxation, the loss may be excessive.

Results of Physical Examination.—The occurrence of such symptoms shortly after delivery would of necessity lead to an accurate examination, when the nature of the case may be at once ascertained. On passing the finger into the vagina, we either find the entire uterus forming a globular mass, to which the placenta is often attached, or, if the inversion be incomplete, the vagina is occupied by a firm, round, and tender swelling, which can be traced upwards through the os uteri. The left hand placed on the abdomen will detect the absence of the round ball of the contracted uterus, and bi-manual examination may even enable us to feel the cup-shaped depression at the site of inversion.

Differential Diagnosis.—When such signs are observed immediately after delivery, mistake is hardly possible. Numerous instances, however, are recorded in which the existence of inversion was not immediately detected, and the tumor formed by it only observed after the lapse of several days, or even longer, when the general symptoms led to vaginal examination. It is probable that in such cases a partial inversion had taken place shortly after delivery, which, as time elapsed, became gradually converted into the more complete variety. In a case of this kind, as in a chronic inversion, some care is necessary to distinguish the inversion from a uterine polypus, which it closely resembles. The cautious insertion of the sound will render the diagnosis certain, since its passage is soon arrested in inversion, while, if the tumor be polypoid, it readily passes in as far as the fundus.

Manner in which Inversion is produced.—The mechanism by which inversion is produced is well worthy of study, and has given rise to much difference of opinion.

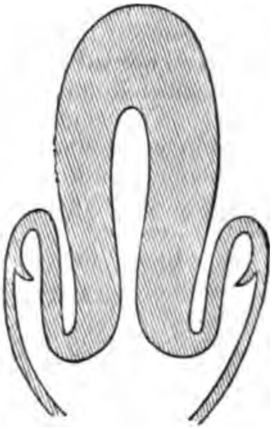
A very general theory is that it is caused, in many cases, by mismanagement of the third stage of labor, either by traction on the cord, the placenta being still adherent, or by improperly applied pressure on the fundus; the result of both these errors being a cup-shaped depression of the fundus, which is subsequently converted into a more complete variety of inversion. That such causes may suffice to start the inversion cannot be doubted; but it is probable that their frequency has been much exaggerated. Still, there are numerous recorded cases in which the commencement of the inversion can be traced to them. Improperly applied pressure (as when the whole body of the uterus is not grasped in the hollow of the hand, but when a monthly nurse, or other uninstructed person, presses on the lower part of the abdomen, so as simply to push down the uterus *en masse*) is often mentioned in histories of the accident. Thus, in the "Edinburgh Medical Journal" for June, 1848, a case is related in which the patient would not have a medical man, but was attended by a midwife, who, after the birth of the child, pulled on the cord, while the patient herself clasped her hands and pushed down her abdomen, at the same time straining forcibly, when the uterus became inverted, and the patient died of hemorrhage before assistance could be procured. Here both the mechanical causes mentioned were in operation. In several cases it is mentioned that the accident occurred while the nurse was compressing the abdomen. That the accident is practically impossible when firm and equable contraction has taken place, can hardly be questioned. Hence it is of paramount importance that the practitioner should himself carefully attend to the conduct of the third stage of labor.

In a large proportion of cases no accidental mechanical causes can be traced, and the occurrence of spontaneous inversion must be admitted. There are various theories held as to how this occurs. Partial and irregular contraction of the uterus is generally admitted to be an important factor in its production; but it is still a matter of dispute whether the inversion is produced mainly by an active contraction of the fundus and body of the uterus, the lower portion and cervix being in a state of relaxation, or whether the precise reverse of this exists, the fundus being relaxed and in a state of quasi-paralysis, while the cervix and lower portion of the uterus are irregularly contracted. The former is the view maintained by Radford and Tyler Smith, while the latter is upheld by Matthews Duncan.

There are good clinical reasons for believing that Duncan's view more nearly corresponds with the true facts of the case; for, if the fundus be really in a state of active contraction, while the cervix is relaxed, we have, as Duncan points out, the very condition which is normal and desirable after delivery, and that which we do our best to produce. If, however, the opposite condition exist, and the fundus be relaxed, while the lower portion is spasmodically contracted, a state exists closely allied to the so-called hour-glass contraction. Supposing now any cause produces a partial depression of the fundus, it is easy to understand how it may be grasped by the contracted portion, and carried more and more down, in the manner of an intro-susception, until complete inversion results. That such partial paralysis often exists, especially about the placental site, was long ago pointed out by Rokitansky, and other pathologists. This theory supposes the original partial depression of the fundus. How this is often produced by mismanagement of the third stage has already been pointed out; but, even in the absence of such causes, it may result from strong bearing-down efforts on the part of the patient, or, as Duncan holds, from the absence of the retentive power of the abdomen. Indeed, the incompatibility of an actively contracted state of the fundus with the partial depression which is essential, according to both views, for the production of inversion, is the strongest argument in favor of Duncan's theory.

Taylor's Theory.—A totally different view has more recently been sustained by Dr. Taylor, of New York, who maintains that "spontaneous active inversion of the uterus rests upon prolonged natural and energetic action of the body and fundus; the cervix, the lower part, yielding first, is thus rolled out, or everted, or doubled up, as there is no obstruction from the contractility of the cervix, which is at rest or functionally paralyzed; the body is gradually, sometimes instantaneously, forced lower and lower, or inverted."[1] That partial inversion may commence at the cervix was pointed out by Duncan in his paper, who depicts it in the accompanying diagram (Fig. 136), and states it to be of not unfrequent occurrence. It is not impossible that occasionally such a state of things should be carried on to complete inversion. But there are serious objections to the acceptance of Dr. Taylor's view that such is the principal cause of inversion, since the process above described would be of necessity a slow and long-continued one, whereas nothing is more certain than that inversion is generally sudden and accompanied by acute symptoms of shock, and is often attended by severe hemorrhage, which could not occur when such excessive contraction was taking place.

FIG. 136.



ILLUSTRATING THE COMMENCEMENT OF INVERSION AT THE CERVIX.

The *treatment* of inversion consists essentially in restoring the organ to its natural position as soon as possible. Every moment's delay only serves to render this more difficult, the inverted portion becoming swollen and strangulated; whereas if the attempt at reposition be made immediately, there is generally comparatively little difficulty in effecting it. Therefore it is of the utmost importance that no time should be lost, and that we should not overlook a partial or incomplete inversion. Hence the occurrence of any unusual shock, pain, or hemorrhage after delivery, without any readily ascertained cause, should always lead to a careful vaginal examination. A want of attention to this rule has too often resulted in the existence of partial inversion being overlooked, until its reduction was found to be difficult or impossible.

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[1] New York Med. Journ., 1872.

Mode of Reduction.—In attempting to reduce a recent inversion, the whole uterus should be grasped in the hollow of the hand and pushed gently and firmly upwards into its former position, great care being taken to apply the pressure in the proper axis of the pelvis, and to use counter-pressure, by the left hand, on the abdominal walls. Barnes lays stress on the importance of directing the pressure towards one side, so as to avoid the promontory of the sacrum. The common plan of endeavoring to push back the fundus first has been well shown by McClintock[1] to have the disadvantage of increasing the bulk of the mass that has to be reduced, and he advises that, while the fundus is lessened in size by compression, we should at the same time endeavor to push up first the part that was last inverted, that is to say, the portion nearest the os uteri. Should this be found impossible, some assistance may be derived from the manœuvre, recommended by Merriman and others, of first endeavoring to push up one side or wall of the uterus, and then the other, alternating the upward pressure from one side to the other as we advance. It often happens, as the hand is thus applied, that the uterus somewhat suddenly reinverts itself, sometimes with an audible noise, much as an india-rubber bottle would do under similar circumstances. When reposition has taken place, the hand should be kept for some time in the uterine cavity, to excite tonic contraction; or Barnes's suggestion of injecting a weak solution of perchloride of iron may be adopted, so as to constrict the uterine walls and prevent a recurrence of the accident.

It is hardly necessary to point out how much these manœuvres will be facilitated by placing the patient fully under the influence of an anæsthetic.

Management of the Placenta.—There has been much difference of opinion as to the management of the placenta in cases in which it is still attached when inversion occurs. Should we remove it before attempting reposition, or should we first endeavor to reinvert the organ, and subsequently remove the placenta? The removal of the placenta certainly much diminishes the bulk of the inverted portion, and, therefore, renders reposition easier. On the other hand, if there be much hemorrhage, as is so frequently the case, the removal of the placenta may materially increase the loss. For this reason, most authorities recommend that an endeavor should be made at reduction before peeling off the afterbirth. But if any delay or difficulty be experienced from the increased bulk, no time should be lost; and it is in every way better to remove the placenta and endeavor to replace the organ as soon as possible.

Supposing we meet with a case in which the existence of inversion has been overlooked for days or even for a week or two, the same procedure may be adopted; but the difficulties are much greater, and the longer the delay the greater they are likely to be. Even now, however, a well-conducted attempt at taxis is likely to succeed. Should it fail, we must endeavor to overcome the difficulty by continuous fluid pressure applied by means of caoutchouc bags distended with water and left in the vagina. It is rarely that this will fail in a comparatively recent case; and such only are now under consideration. It is likely that by fluid pressure applied in this way for twenty-four or forty-eight hours, and then followed by taxis, any case detected before the involution of the uterus is completed may be successfully treated.

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[1] Diseases of Women, p. 7[illegible].

PART IV.

OBSTETRIC OPERATIONS.

CHAPTER I.

INDUCTION OF PREMATURE LABOR.

THE first of the obstetric operations we have to consider is the *induction of premature labor*, an operation which, like the forceps, was first suggested and used in this country, and the recognition of which as a legitimate procedure we also chiefly owe to the labor of our fellow-countrymen, in spite of much opposition both at home and abroad. It is not known with certainty to whom we owe the original suggestion; but we are told by Denman that in the year 1756 there was a consultation of the most eminent physicians at that time in London, to consider the advantages which might be expected from the operation. The proposal met with formal approval, and was shortly after carried into practice by Dr. Macaulay, the patient being the wife of a linendraper in the Strand. From that time it has flourished in Great Britain, the sphere of its application has been largely increased, and we have the satisfaction of knowing that it has been the means of saving many mothers and children who would otherwise, in all probability, have perished. On the Continent it was long before the operation was sanctioned or practised. Although recommended by some of the most eminent German practitioners, it was not actually performed until the year 1804. In France the opposition was long-continued and bitter. Many of the leading teachers strongly denounced it, and the Academy of Medicine formally discountenanced it so late as the year 1827. The objections were chiefly based on religious grounds, but partly, no doubt, on mistaken notions as to the object proposed to be gained. Although frequently discussed, the operation was never actually carried into practice until the year 1831, when Stoltz performed it with success. Since that time opposition has greatly ceased, and it is now employed and highly recommended by the most distinguished obstetricians of the French schools.

Objects of the Operation.—In inducing premature labor, we propose
id or lessen the risk to which, in certain cases, the mother is ex-
delivery at term, or to save the life of the child, which might
be endangered. Hence the operation may be indicated either

on account of the mother alone, or of the child alone, or, as not unfrequently happens, of both together.

In by far the largest number of cases the operation is performed on account of defective proportion between the child and the maternal passages, due to some abnormal condition on the part of the mother. This want of proportion may depend on the presence of tumors either of the uterus or growing from the pelvis. But most frequently it arises from deformity of the pelvis (p. 357); and it is needless to repeat what has been said on that point. I shall, therefore, only briefly refer to a few more uncommon causes which occasionally necessitate its performance.

One of these is an habitually large, or over-firmly ossified, fœtal head. Should we meet with a case in which the labors are always extremely difficult, and the head apparently of unusual size, although there be no apparent want of space in the pelvis, the induction of labor would be perfectly justifiable, and in all probability would accomplish the desired object. In such cases the proper period of delivery would require to be anticipated by a very short time. A week or a fortnight might make all the difference between a labor of extreme severity and one of comparative ease.

There is a large class of cases in which the condition of the mother indicates the operation. Many of these have already been considered when treating of the diseases of pregnancy. Amongst them may be mentioned uncontrollable vomiting, which has resisted all treatment, and which has produced a state of exhaustion threatening to prove fatal; chorea, albuminuria, convulsions, or mania may also be aggravated or originated by pregnancy; excessive anasarca, ascites, or dyspnœa, connected with disease of the heart, lungs, or liver, may be in a great measure caused by the pressure of the enlarged uterus; in fact, any condition or disease affecting the mother, provided only we are convinced that the termination of pregnancy would give the patient relief, and that its continuance would involve serious danger. It need hardly be pointed out that the induction of labor for any such causes involves grave responsibility, and is decidedly open to abuse; no practitioner would, therefore, be justified in resorting to it, especially if the child have not reached a viable age, without the most anxious consideration. No general rules can be laid down. Each case must be treated on its own merits. It is obvious that the nearer the patient is to the full period, the greater will be the chance of the child surviving, and the less hesitation need then be felt about consulting the interests of the mother.

In another class of cases the operation is indicated by circumstances affecting the life of the child alone. Of these the most common are those in which the child dies, in several successive pregnancies, before the termination of utero-gestation. This is generally the result of fatty, calcareous, or syphilitic degeneration of the placenta, which is thus rendered incapable of performing its functions. These changes in the placenta seldom commence until a comparatively advanced period of pregnancy; so that if labor be somewhat hastened, we may hope to enable the patient to give birth to a living and healthy child. The previous experience of the mother will indicate the period at which the death of the fœtus has formerly taken place, as she would then have appreciated a difference in her sensations, a diminution in the vigor of the fœtal movements, a sense of weight and coldness, and similar signs. For some weeks before the time at which this change has formerly been experienced, we should carefully auscultate the fœtal heart from day to day, and in most cases the approach of danger will be indicated sufficiently soon to enable us to interfere with success, by tumultuous and irregular pulsations, or a failure in their strength and frequency. On the detection of these, or on the mother feeling that the movements of the child are becoming less strong, the operation should at once be performed. Simpson also induced premature labor with success in a patient who twice gave birth to hydrocephalic children. In the third pregnancy, which he terminated before the natural period, the child was well formed and healthy.

Some obstetricians have proposed to induce labor, with the view of saving the child, when the mother was suffering from mortal disease. This indication is, however, so extremely doubtful from a moral point of view, that it can hardly be considered as ever justifiable.

The means adopted for the induction of labor are very numerous. Some of them act through the maternal circulation, as the administration of ergot, and other oxytocics; others by their power of exciting reflex action, or by interfering with the integrity of the ovum, or by a combination of both, as the vaginal douche, the separation of the membranes from the uterine walls, the puncture of the ovum, dilatation of the os, stimulating enemata, or irritation of the breasts. The former class are never employed in modern obstetric practice. Of the latter, some offer special advantages in particular cases, but none are equally adapted for all emergencies. Often a combination of more methods than one will be found most useful. I shall mention the various methods in use, and discuss briefly the relative advantages and disadvantages of each.

Puncture of Membranes.—The evacuation of the liquor amnii, by the puncture of the membranes, was the first method practised, and was that recommended by Denman and all the earlier writers. It is the most certain which can be employed, as it never fails, sooner or later, to induce uterine contractions. There are, however, several disadvantages connected with it, which are sufficient to contra-indicate its use in the majority of cases. It is uncertain as regards the time taken in producing the desired effect, pains sometimes coming on within a few hours, but occasionally not until several days have elapsed. The contracting walls of the uterus will press directly on the body of the child, which, being frail and immature, is less able to bear the pressure than at the full period of pregnancy. Hence it involves great risk to the fœtus. Besides, the escape of the water does away with the fluid wedge so useful in dilating the os, and should version be necessary from malpresentation—a complication more likely to occur than in natural labor—the operation would have to be performed under very unfavorable conditions. These objections are sufficient to justify the ordinary opinion that this procedure should not be adopted unless other means have been first tried and failed. Every now and then cases are met with in which it is extremely difficult to arouse the uterus to action, and under such circumstances, in spite of its drawbacks, this method will be found to be very valuable. When the operation has to be performed before the child is viable—that is, before the seventh month—these objections do not hold, and then it is the simplest and readiest procedure we can adopt. Indeed, in producing early abortion no other is practicable. The operation itself is most simple, requiring only a quill, stiletted catheter, or other suitable instrument, to be passed up to the os, carefully guarded by the fingers of the left hand previously introduced, and to be pressed against the membranes until perforation is accomplished. Meissner, of Leipsic, has proposed, as a modification of this plan, that the membranes should be punctured obliquely, three or four inches above the os, so as to admit of a gradual and partial escape of the amniotic fluid, thus lessening the risk to the child from pressure by the uterus. For this purpose he employed a curved silver canula, containing a small trocar, which can be projected after introduction. The risk of injuring the uterus by such an instrument would be considerable, and we have other and better means at our command which render it unnecessary. When we require to produce early abortion, it would be well not to attempt to puncture the membranes with a sharp pointed instrument. The object can be effected with equal certainty, and greater safety, by passing an ordinary uterine sound through the os, and turning it round once or twice.

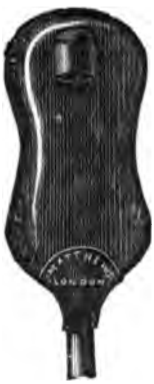
Administration of Oxytocics.—The administration of ergot of rye, either alone, or combined with borax and cinnamon, has been sometimes resorted to. This practice has been principally advocated by Ramsbotham, who was in the habit of exhibiting scruple doses of the powdered ergot every fourth hour, until delivery took place. Sometimes he found that as many as thirty or forty doses were required to effect the object; occasionally labor commenced after a single dose. Finding that the infantile mortality was very great when this method was followed, he modified it, and administered two or three doses only, and, if these proved insufficient, he punctured the membranes. There can be no doubt that ergot possesses the power of inducing uterine contractions. The risk to the child is, however, quite as great as when the membranes are punctured; for not only is it subject to injurious pressure from the tumultuous and irregular contractions which the ergot produces, but the drug itself, when given in large doses, seems to exert a poisonous influence on the fœtus. For these reasons ergot may properly be excluded from the available means of inducing labor.

Various methods have been recommended which act indirectly on the uterus, the source of irritation being at a distance. Thus, D'Outrepont used frequently-repeated abdominal frictions and tight bandages. Scanzoni, remembering the intimate connection between the mammæ and uterus, and the tendency which irritation of the former has to induce contraction of the latter, recommended the frequent application of cupping-glasses to the breasts. Radford and others have employed galvanism. Stimulating enemata have been employed. All these methods have occasionally proved successful, and, unlike the former plans we have mentioned, they are not attended by any special risk to the child.

They are, however, much too uncertain to be relied on, besides being irksome both to the patient and practitioner.

The artificial dilatation of the os uteri in imitation of its natural opening in labor, was first practised by Klüge. He was in the habit of passing within the os a tent made of compressed sponge, and allowing it to dilate by imbibition of fluid. If labor were not provoked within twenty-four hours, he removed it, and introduced a fresh one of larger dimensions, changing it as often as was necessary until his object was accomplished. Although this operation seldom failed to induce labor, it had the disadvantage of occupying an indefinite time, and the irritation produced was often painful and annoying. Dr. Keiller, of Edinburgh, was the first to suggest the use of caoutchouc bags distended by air, as a means of dilating the os. This plan has been perfected by Dr. Barnes in his well-known dilators, which are of great use in many cases in which artificial dilatation of the cervix is necessary. They consist of a series of india-rubber bags of various sizes, with a tube attached (Fig. 137), through which water can be injected by an ordinary Higginson's syringe. They have a small pouch fixed externally, in which a sound can be placed, so as to facilitate their introduction. When distended with water, the bags assume somewhat of a fiddle shape, bulging at both extremities, which ensures their being retained within the os. When first introduced into practice as a means of inducing labor, it was thought that this method gave a complete control over the process, so that it could be concluded within a definite time at the will of the operator. The experience of those who have used it much has certainly not justified this anticipation. It is true that, occasionally, contractions supervene within a few hours after dilatation has been commenced; but, on the other hand, the uterus often responds very imperfectly to this kind of stimulus, and the bags may be inserted for many consecutive hours without the desired result supervening, the puncture of the membranes being eventually necessary in order to hasten the process. Indeed, my own experience would lead me to the conclusion that, as a means of evoking uterine contraction, cervical dilatation is very unsatisfactory. Dr. Barnes himself has evidently seen reason to modify his original views, for, while he at first talked of the bags as enabling us to induce labor with certainty at a given time, he has since recommended that uterine action should be first provoked by other means, the dilators being subsequently used to accelerate the labor thus brought on. The bags thus employed find, as I believe, their most useful and a very valuable application; but when used in this way they cannot be considered a means of originating uterine action. A subsidiary objection to the bags is the risk of displacing the presenting part. I have, for example, introduced them when the head was presenting, and, on their removal, found the shoulder lying over the os. It is not difficult to understand how the continuous pressure of a distended bag in the internal os might easily

FIG. 137.



BARNES'S BAG FOR DILATING THE CERVIX.

push away the head, which is so readily movable as long as the membranes are unruptured. Still, if labor be in progress, and the os insufficiently dilated, the possibility of this occurrence is not a sufficient reason for not availing ourselves of the undoubtedly valuable assistance which the dilators are capable of giving.

Separation of the Membranes.—Some processes for inducing labor act directly on the ovum, by separating the membranes, to a greater or less extent, from the uterine walls. The first procedure of the kind was recommended by Dr. Hamilton, of Edinburgh, and consisted in the gradual separation of the membranes for one or two inches all round the lower segment of the uterus. To reach them the finger had to be gently insinuated into the interior of the os, which was gradually dilated to a sufficient extent by a series of successive operations, repeated at intervals of three or four hours. When this had been accomplished, the fore-finger was inserted and swept round between the membranes and the uterus; but it was frequently found necessary to introduce the greater part of the hand to effect the object, and sometimes even this was not sufficient, and a female catheter or other instrument had to be used for the purpose. The method was generally successful in bringing on labor, but it now and then failed, even in Dr. Hamilton's hands. It is certainly based on correct principles, but it is tedious and painful both to the practitioner and patient, and very uncertain in its time of action. For these reasons it has never been much practised.

Vaginal and Uterine Douches.—In the year 1836, Kiwisch suggested a plan, which, from its simplicity, has met with much approval. It consists in projecting, at intervals, a stream of warm or cold water against the os uteri. Its action is doubtless complex. Kiwisch himself believed that relaxation of the soft parts, through the imbibition of water, was the determining cause of labor. Simpson found that the method failed unless the water mechanically separated the membranes from the uterine walls. Besides this effect, it probably directly induces reflex action, by distending the vagina and dilating the os. In using it, it has been customary to administer a douche twice daily, and more frequently if rapid effects be desired. The number required varies in different cases. The largest number Kiwisch found it necessary to use was 17, the smallest 4. The average time that elapses before labor sets in is four days. Hence the method is obviously useless when rapid delivery is required.

Dr. Cohen, of Hamburg, introduced an important modification of the process, which has been considerably practised. It consists in passing a silver or gum-elastic catheter some inches within the os, between the membranes and the uterine walls, and injecting the fluid through it directly into the cavity of the uterus. He used creosote, or tar-water, and injected, without stopping, until the patient complained of a feeling of distension. Others have found the plan equally efficacious when they only employed a small quantity of plain water, such as 7 or 8 ounces. Professor Lazarewitch, of Charkoff, is a strong advocate of this method. He believes that uterine action is evoked much more rapidly and certainly if the water be injected near the fundus, and he has contrived an instrument for the purpose, with a long metallic nozzle.

So many fatal cases have followed these methods that it cannot be doubted that, in spite of their certainty and simplicity, there is an element of risk in them which should not be overlooked. Many of these are recorded in Barnes's work, and he comes to the conclusion, which the facts unquestionably justify, that "the douche, whether vaginal or intra-uterine, ought to be absolutely condemned as a means of inducing labor." The precise reason of the danger is not very obvious. Sudden stretching of the uterine walls, producing shock, has been supposed to have caused it; but in many of the fatal cases the symptoms have been rather those attending the passage of air into the veins, and it is easy to understand how air may have been introduced, in this way, into the large uterine sinuses.

Injection of Carbonic Acid Gas.—Simpson and Scanzoni have both tried with success the injection of carbonic acid gas into the vagina. Fatal results have, however, followed its employment, and Simpson has expressed an opinion that the experiment should not be repeated.

Simpson's Method of Operating.—Simpson originally induced labor by passing the uterine sound within the os, and up towards the fundus, and, when it had been inserted to a sufficient extent, moving it slightly from side to side. He was led to adopt this procedure in the belief that we might thus closely imitate the separation of the decidua, which occurs previous to labor at term. Uterine contractions were induced with certainty and ease, but it was found impossible to foretell what time might elapse between the commencement of labor and the operation, which had frequently to be performed more than once. He subsequently modified this procedure by introducing a flexible male catheter, without a stilette, which he allowed to remain in the uterus until contractions were excited. This plan is much used in Germany, and is now that which is also most frequently adopted in this country. It is simple and very efficacious, pains coming on, almost invariably, within twenty-four hours after the catheter or bougie is introduced. A theoretical objection is the possibility of the catheter separating a portion of the placenta and giving rise to hemorrhage; but in practice this has not been found to occur, and the risk might generally be avoided by introducing the catheter at a distance from the placenta, the probable situation of which has been ascertained by auscultation. The more deeply the catheter is introduced, the more certain and rapid is its effect; and not less than seven inches should be pushed up within the os. It is not always easy to insert it so far, especially if a flexible catheter be used, which is apt to be too pliable to pass upwards with ease. A solid bougie—male urethral bougie—should, therefore, be employed, and I have found its introduction greatly facilitated by anæsthetizing the patient and passing the greater part of the hand into the vagina. In this way it can be pushed in very gently, and without any risk of injury to the uterus. There is some chance of rupturing the membranes while pushing it upwards. This accident, indeed, cannot always be avoided, even when the greatest care is taken; but when it occurs the puncture will be at a distance from the os, so that a small portion only of the liquor amnii will escape, and this can scarcely be considered a serious objection. It is always an advantage to allow the pains to come on gradually, and in imitation of natural labor. Therefore, if, after the bougie has been inserted for a sufficient time, uterine contractions come on sufficiently strongly, we may then leave the case to be terminated naturally; or, if they be comparatively feeble, we may resort to the accelerative procedures recommended by Barnes—the dilatation of the cervix by the fluid bags, and subsequently the puncture of the membranes. In this way we have the labor completely under control; and I believe this method will commend itself to those who have experience of it, as the simplest and most certain mode of inducing labor yet known, and the one most closely imitating the natural process.

It should not be forgotten that the child is immature, and that unusual care is likely to be required to rear it successfully. We should, therefore, be careful to have at hand all the usual means of resuscitation; and, as the mother may not be able to nurse at once, it would be a good precaution to have a healthy wet-nurse in readiness.

CHAPTER II.

TURNING.

TURNING, by which we mean the alteration of the position of the fœtus, and the substitution of some other portion of the body for that originally presenting, is one of the most important of obstetric operations, and merits careful study. It is also one of the most ancient, and was evidently known to the Greek and Roman physicians. Up to the fifteenth century, cephalic version—that in which the head of the fœtus is brought over the os uteri—was almost exclusively practised, when Paré and his pupil Guillemeau taught the propriety of bringing the feet down first. It was by the latter physician especially that the steps of the operation were clearly defined; and the French have undoubtedly the merit both of perfecting its performance and of establishing the indications which should lead to its use. Indeed, it was then much more frequently performed than in later times, since no other means of effecting artificial delivery were known which did not involve the death of the child; and practitioners, doubtless, acquired great skill in its performance, and were inclined to overrate its importance, and extend its use to unsuitable cases. An opposite error was fallen into after the invention of the forceps, which for a time led to the abandonment of turning in certain conditions for which it was well adapted, and in which it has only of late years been again practised.

Cephalic version has, since Paré wrote, been recommended and practised from time to time, but the difficulty of performing it satisfactorily was so great that it never became an established operation. Dr. Braxton Hicks has perfected a method by which it can be accomplished with greater ease and certainty, and which renders it a legitimate and satisfactory resort in suitable cases. To him we are also indebted for introducing a method of turning without passing the entire hand into the cavity of the uterus, which, under favorable circumstances, is not only easy of performance, but deprives the operation of one of its greatest dangers.

The possibility of effecting version by external manipulation has been long known, and was distinctly referred to and recommended by Dr. John Pechey,[1] so far back as the year 1698. Since that time it has been strongly advocated by Wigand and his followers; and various authors in this country, notably Sir James Simpson, have referred to the advantage to be derived from external manipulation assisting the hand in the interior of the uterus. To Dr. Hicks, however, incontestably belongs the merit of having been the first distinctly to show the possibility of effecting complete version by combined external and internal manipulation, of laying down definite rules for its practice, and of thus popularizing one of the greatest improvements in modern midwifery.

Object and Nature of the Operation.—The operation is entirely dependent for success on the fact that the child in utero is freely movable and that its position may be artificially altered with facility. As long as the membranes are unruptured, and the fœtus is floating in the surrounding fluid medium, it is liable to constant changes in position, as may be readily demonstrated in the latter months of pregnancy; and the operation, under these circumstances, may be performed with the greatest facility. Shortly after the liquor amnii has escaped, there is still, as a rule, no great difficulty in effecting version; but, as the body is no longer floating in the surrounding liquid, its rotation must necessarily be attended with some increased risk of injury to the uterus. If the liquor amnii have been long evacuated, and the muscular structure of the uterus be strongly contracted, the fœtus may be so firmly fixed that any attempt to move it is surrounded with the greatest difficulties, and may even fail entirely, or be attended with such risks to the maternal structures as to be quite unjustifiable.

Cases suitable for the Operation.—Version may be required either on account of the mother or child alone; or it may be indicated by some condition imperilling both, and rendering immediate delivery necessary. The chief cases in which it is resorted to are those of transverse presentations, where it is absolutely essential; accidental or unavoidable hemorrhage; certain cases of contracted pelvis; and some complications, especially prolapse of the funis. The special indications for the operation have been separately discussed under these subjects.

The ordinary statistical tables cannot be depended on as giving any reliable results as to the risks of the operation. Taking all cases together, Dr. Churchill estimates the maternal mortality as 1 in 16, and the infantile as 1 in 3. Like all similar statistics, they are open to the objection of not distinguishing between the results of the operation itself, and of the cause which necessitated interference. Still, they are sufficient to show that the operation is not free from grave hazards, and that it must not be undertaken without due reflection. The principal dangers will be discussed as we proceed. It may suffice to mention here that those to the mother must vary with the period at which the operation is undertaken. If version be performed early, before the rupture of the membranes, or, in favorable cases, without the introduction of the hand into the interior of the uterus, the risk must of course be infinitely less than in those more formidable cases in which the waters have long escaped and the hand and arm have to be passed into an irritable and contracted uterus. But even in the most unfavorable cases accidents may be avoided, if the operator bear constantly in mind that the principal danger consists in laceration of the uterus or vagina from undue force being employed, or from the hand and arm not being introduced in the axis of the passages. There is no operation in which gentleness, absence of all hurry, and complete presence of mind are so essential. A certain number of cases end fatally from shock or exhaustion, or from subsequent complications. As regards the child, the mortality is little, if at all, greater than in original breech and footling presentations. Nor is there any good reason why it should be so, seeing that cases of turning, after the feet are brought through the os, are virtually reduced to those of feet presentation, and that the mere version, if effected sufficiently soon, is not likely to add materially to the risk to which the child is exposed.

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[1] The Complete Midwife's Practice, p. 142.

The possibility of effecting *version by external manipulation* has been recognized by various authors, and was made the subject of an excellent thesis by Wigand, who clearly described the manner of performing the operation. In spite of the manifest advantages of the procedure, and the extreme facility with which it can be accomplished in suitable cases, it has by no means become the established custom to trust to it, and probably most practitioners have never attempted it, even under the most favorable conditions. The possibility of operation is based on the extreme mobility of the fœtus before the membranes are ruptured. After the waters have escaped, the uterine walls embrace the fœtus more or less closely, and version can no longer be readily performed in this manner.

Cases suitable for the Operation.—It may, therefore, be laid down as a rule that it should only be attempted when the abnormal position of the fœtus is detected before labor has commenced, or in the early stage of labor, when the membranes are unruptured. It is also unsuitable for any but transverse presentations, for it is not meant to effect complete evolution of the fœtus, but only to substitute the head for the upper extremity. It is useless whenever rapid delivery is indicated, for, after the head is brought over the brim, the conclusion of the case must be left to the natural powers.

Method of Performance.—The manner of detecting the presentation by palpation has been already described (p. 110), and the success of the operation depends on our being able to ascertain the positions of the head and breech through the uterine walls. Should labor have commenced, and the os be dilated, the transverse presentation may be also made out by vaginal examination. Should the abnormal presentation be detected before labor has actually begun, it is, in most cases, easy enough to alter it, and to bring the fœtus into the longitudinal axis of the uterine cavity. It is seldom, however, discovered until labor has begun, and, even if it be altered, the child is extremely apt to reassume, in a short time, the faulty position in which it was formerly lying. Still, there can be no harm in making the attempt, since the operation itself is in no way painful, and is absolutely without risk either to the mother or child. When the transverse presentation is detected early in labor, I believe it is good practice to endeavor to remedy it by external manipulation, and, if it fail, we may at once proceed to other and more certain methods of operating. The procedure itself is abundantly simple. The patient is placed on her back, and the position of the fœtus ascertained by palpation, as accurately as possible, in the manner already indicated. The palms of the hands being then placed over the opposite poles of the fœtus, by a series of gentle gliding movements, the head is pushed towards the pelvic brim, while the breech is moved in the opposite direction. The facility with which the fœtus may sometimes be moved in this way can hardly be appreciated by those who have never attempted the operation. As soon as the change is effected, the long diameters of the fœtus and of the uterus will correspond, and vaginal examination will show that the shoulder is no longer presenting, and that the head is over the pelvic brim. If the os be sufficiently dilated, and labor in progress, the membranes should now be punctured, and the position of the fœtus maintained for a short time by external pressure, until we are certain that the cephalic presentation is permanently established. If labor be not in progress, an attempt may at least be made to effect the same object by pads and a binder; one pad being placed on the side of the uterus in the situation of the breech, and another on the opposite side in the situation of the head.

On account of the difficulty of performing *cephalic version* in the manner usually recommended, it has practically scarcely been attempted, and, with the exception of some more recent authors, it is generally condemned by writers on systematic midwifery. Still, the operation offers unquestionable advantages in those transverse presentations in which rapid delivery is not necessary, and in which the only object of interference is the rectification of malposition; for, if successful, the child is spared the risk of being drawn footling through the pelvis. The objections to cephalic version are based entirely on the difficulty of performance; and, undoubtedly, to introduce the hand within the uterus, search for, seize, and afterwards place the slippery head in the brim of the pelvis, could not be an easy process, even under the most favorable circumstances, and must always be attended by considerable risk to the mother. Velpeau, who strongly advocated the operation, was of opinion that it might be more easily accomplished by pushing up the presenting part than by seizing and bringing down the head. Wigand more distinctly pointed out that the head could be brought to a proper position by external manipulation, aided by the fingers of one hand within the vagina. Dr. Hicks has laid down clear rules for its performance, which render cephalic version easy to accomplish under favorable conditions, and will doubtless cause it to become a recognized mode of treating malpositions. The number of cases, however, in which it can be performed must always be limited, since, as in turning by external manipulation alone, it is necessary that the liquor amnii should be still retained, or at least have only recently escaped; that the presentation be freely movable above the pelvic brim; and that there be no necessity for rapid delivery. Dr. Hicks does not believe protrusion of the arm to be a contra-indication, and advises that it should be carefully replaced within the uterus. When, however, protrusion of the arm has occurred, the thorax is so constantly pushed down into the pelvis that replacement can neither be safe nor practicable, except under unusually favorable conditions, and podalic version will be necessary.

Method of Performance.—It is impossible to describe the method of performing cephalic version more concisely and clearly than in Dr. Hicks's own words. "Introduce," he says, "the left hand into the vagina, as in podalic version; place the right hand on the outside of the abdomen, in order to make out the position of the fœtus and the direction of its head and feet. Should the shoulder, for instance, present, then push it with one or two fingers in the direction of the feet. At the same time pressure with the other hand should be exerted on the cephalic end of the child. This will bring the head down to the os; then let the head be received on the tips of the inside fingers. The head will play like a ball between the two hands; it will be under their command, and can be placed in almost any part at will. Let the head then be placed over the os, taking care to rectify any tendency to face presentation. It is as well, if the breech will not rise to the fundus readily after the head is fairly in the os, to withdraw the hand from the vagina, and with it press up the breech from the exterior. The hand which is retaining gently the head from the outside should continue there for some little time, till the pains have ensured the retention of the child in its new position and the adaptation of the uterine walls to its new form. Should the membranes be perfect, it is advisable to rupture them as soon as the head is at the os uteri; during their flow, and after, the head will move easily into its proper position."

The procedure thus described is so simple, and would occupy so short a time, that there can be no objection to trying it. Should we fail in our endeavors, we shall not be in a worse position for effecting delivery by podalic version, which can be proceeded with without withdrawing the hand from the vagina or in any way altering the position of the patient.

The method of performing *podalic version* varies with the nature of each particular case. In describing the operation, it has been usual to divide the cases into those in which the circumstances are favorable, and the necessary manœuvres easily accomplished; and those in which there are likely to be considerable difficulties, and increased risk to the mother. This division is eminently practical, since nothing can be more variable than the circumstances under which version may be required. Before describing the steps of the operation, it may be well to consider some general conditions applicable to all cases alike.

Position of the Patient.—In this country the ordinary position on the left side is usually employed. On the Continent and in America the patient is placed on her back, with the legs supported by assistants, as in lithotomy. The former position is preferable, not only as a matter of custom, and as involving much less fuss and exposure of the person, but because it admits of both the operator's hands being more easily used in concert. In certain difficult cases, when the liquor amnii has escaped, and the back of the child is turned towards the spine of the mother, the dorsal decubitus presents some advantages in enabling the hand to pass more readily over the body of the child; but such cases are comparatively rare. The patient should be brought to the side of the bed, across which she should be laid, with the hips projecting over, and parallel to, the edge, the knees being flexed towards the abdomen, and separated from each other by a pillow, or by an assistant. Assistants should also be placed so as to restrain the patient if necessary, and prevent her involuntarily starting from the operator, as this might not only embarrass his movements, but be the cause of serious injury.

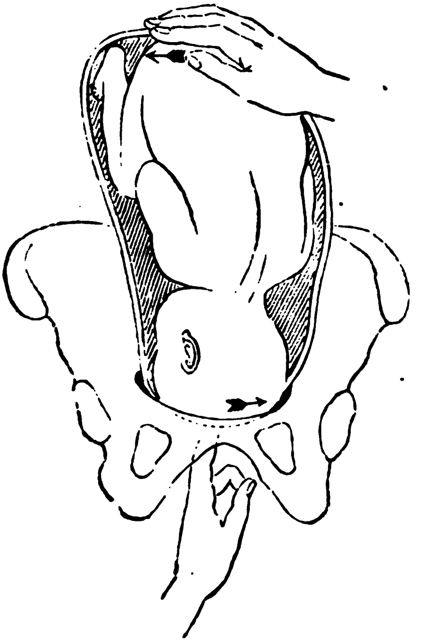
Administration of Anæsthetics.—The exhibition of anæsthetics is peculiarly advantageous. There is nothing which tends to facilitate the steps of the process so much as stillness on the part of the patient, and the absence of strong uterine contraction. When the vagina is very irritable and the uterus firmly contracted round the body of the child, complete anæsthesia may enable us to effect version, when without it we should certainly fail.

The most favorable time for operating is when the os is fully dilated, before, or immediately after, the rupture of the membranes and the discharge of the liquor amnii. The advantage gained by operating before the waters have escaped cannot be overstated, since we can then make the child rotate with great facility in the fluid medium in which it floats. In the ordinary operation, in which the hand is passed into the uterus, it is essential to wait until the os is of sufficient size to admit its being introduced with safety. This may generally be done when the os is the size of a crown piece, especially if it be soft and yielding.

The practice followed with regard to the hand to be used in turning varies considerably. Some accoucheurs always employ the right hand, others the left, and some one or other according to the position of the child. In favor of the right hand, it is said that most practitioners have more power with it, and are able to use it with greater gentleness and delicacy. In transverse presentations, if the abdomen of the child be placed anteriorly, the right hand is said to be the proper one to use, on account of the greater facility with which it can be passed over the front of the child; and in difficult cases of this kind, when we are operating with the patient on her back, it certainly can be employed with more precision than the left. In all ordinary cases, however, the left hand can be introduced much more easily in the axis of the passages, the back of the hand adapts itself readily to the curve of the sacrum, and, even when the child's abdomen lies anteriorly, it can be passed forwards without difficulty so as to seize the feet. These advantages are sufficient to recommend its use, and very little practice is required to enable the practitioner to manipulate with it as freely as with the right. If, in addition, we remember the important fact that the right hand is required to operate on the fœtus through the abdominal walls—and this is a point which should never be forgotten—we shall have abundant reasons for laying it down as a rule that the left hand should generally be employed. Before passing the hand and arm they should be freely lubricated, with the exception of the palm, which is left untouched to admit of a firm grasp being taken of the fœtal limbs. It is also advisable to remove the coat, and bare the arm as high as the elbow.

As it should be a cardinal rule to resort to the simplest procedure when practicable, in describing podalic version it will be well to consider first the method by combined external and internal manipulation without passing the hand into the uterus, and subsequently that which involves the introduction of the hand.

FIG. 188.

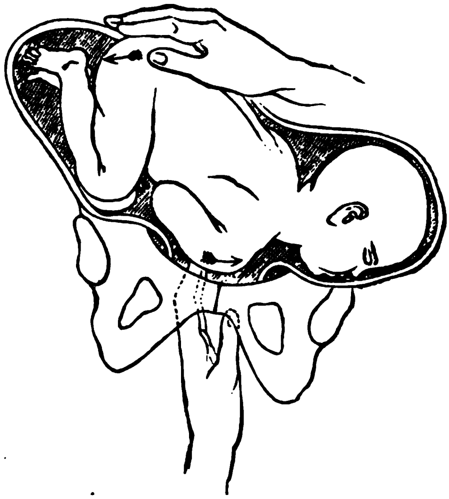


FIRST STAGE OF BI-POLAR VERSION.
ELEVATION OF THE HEAD AND DEPRESSION OF THE BREECH.

To effect podalic version by the combined method it is an essential preliminary to ascertain the situation of the fœtus as accurately as possible. It will generally be easy, in transverse presentations, to make out the breech and the head by palpation; while in head presentations the fontanelles will show to which side of the pelvis the face is turned. The left hand is then to be passed carefully into the vagina, in the axis of the canal, to a sufficient extent to admit of the fingers passing freely into the cervix. To effect this, it is not always necessary to insert the whole hand, three or four fingers being generally sufficient.

If the head lie in the first or fourth position, push it upwards and to the left, while the other hand, placed externally on the abdomen, depresses the breech towards the right (Fig. 138). By this means we act simultaneously on both extremities of the child's body, and easily alter its position. The breech is pushed down gently but firmly, by gliding the hand over the abdominal wall. The head will now pass out of reach, and the shoulder will arrive at the os, and will lie on the tips of the fingers. This is similarly pushed upwards in the same direction as

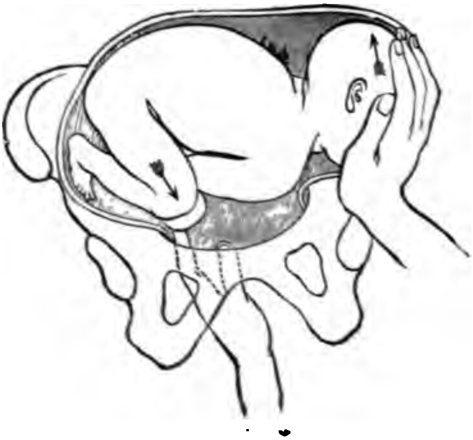
FIG. 139.



SECOND STAGE OF BI-POLAR VERSION.

ELEVATION OF THE SHOULDERS AND DEPRESSION OF THE BREECH.

FIG. 140.

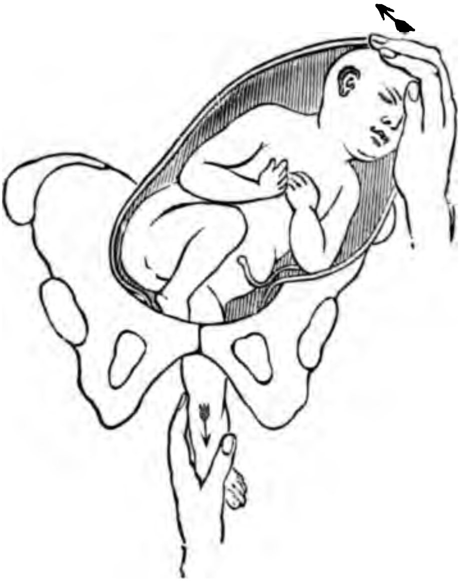


THIRD STAGE OF BI-POLAR VERSION.

SEIZURE OF THE KNEE AND PARTIAL ELEVATION OF THE HEAD.

the head (Fig. 139), the breech at the same time being still further depressed, until the knee comes within reach of the fingers, when (the membranes being now ruptured, if still unbroken) it is seized and pulled down through the os (Fig. 140). Occasionally the foot comes immediately over the os, when it can be seized instead of the knee. Version may be facilitated by changing the position of the external hand, and pushing the head upwards from the iliac fossa, instead of continuing the attempt to depress the breech (Fig. 141). These manipulations should always be carried on in the intervals, and desisted from when the pains come on; and when they recur with great force and frequency, the advantage of chloroform will be particularly apparent. In the second and third positions the steps of the operation should be reversed; the head is pushed upwards and to the right, the breech downwards and to the left. When the position cannot be made out with certainty, it is well to assume that it is the first, since that is the one most frequently met with; and even if it be not, no great inconvenience is likely to occur. If the os be not sufficiently open to admit of delivery being concluded, the lower extremity can be retained in its new position with one finger, until dilatation is sufficiently advanced, or until the uterus has permanently adapted itself to the altered position of the child, either of which results will generally be effected in a short space of time.

FIG. 141.



FOURTH STAGE OF BI-POLAR VERSION.
DRAWING DOWN OF LEG, AND COMPLETION OF VERSION.

In transverse presentations the same means are to be adopted, the shoulder being pushed upwards in the direction of the head, while the breech is depressed from without. This is frequently sufficient to bring the knees within reach, especially if the membranes be entire, but version is much facilitated by pressing the head upwards from without, alternately with depression of the breech. If the liquor amnii have escaped, and the uterus be firmly contracted round the body of the child, it will be found impossible to effect an alteration in its position without the introduction of the hand, and the ordinary method of turning must be employed. The peculiar advantage of the combined process is that it in no way interferes with the latter, for should it not succeed the hand can be passed on into the uterus without withdrawal from the vagina (provided the os be sufficiently dilated), and the feet or knees seized and brought down.

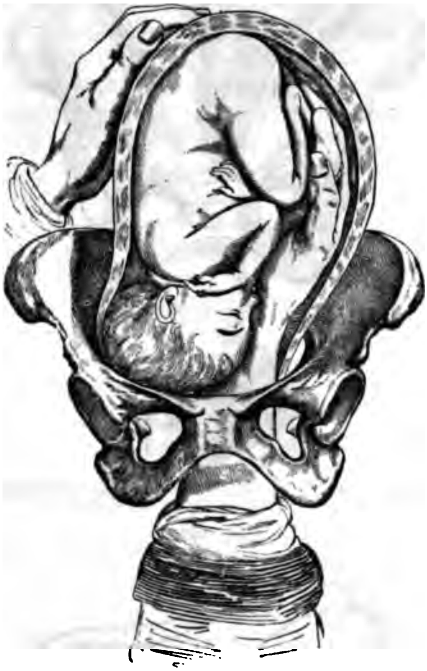
Turning, with the hand introduced into the uterus, provided the waters have not escaped, or have only recently done so, and the os be sufficiently dilated, is an operation generally performed with extreme facility.

Introduction of the Hand.—The first step, and one of the most important, is the introduction of the hand and arm. The fingers having been pressed together in the form of a cone, the thumb lying between the rest of the fingers, the hand, thus reduced to the smallest possible dimensions, is slowly and carefully passed into the vagina, in the axis of the outlet, in an interval between the pains, and passed onwards in the same cautious manner, and with a semi-rotatory motion, until it lies entirely within the vagina, the direction of introduction being gradually changed from the axis of the outlet to that of the brim. If uterine contractions come on, the hand should remain passive until they are over. It should ever be borne in mind, as one of the fundamental rules in performing version, that we should act only in the absence of pains, and then with the utmost gentleness—all force and violent pushing being strictly avoided. The hand, still in the form of a cone, having arrived at the os, if this be sufficiently dilated, may be passed through at once. If the os be not quite open, but dilatable, the points of the fingers may be gently insinuated, and occasionally expanded, so as to press it open sufficiently to permit the rest of the hand to pass. While this is being done, the uterus should be steadied by the other hand placed externally, or by an assistant. If the presentation should not previously have been made out with accuracy, we can now positively ascertain how to pass the hand onwards, so that its palmar surface may correspond with the abdomen of the child.

Rupture of the Membranes.—The membranes should now be ruptured—if possible during the absence of a pain—so as to prevent the waters being forced out. The hand and arm form a most efficient plug, and the liquor amnii cannot escape in any quantity. Some practitioners recommend that, before rupturing the membranes, the hand should be passed onwards between them and the uterine walls, until we reach the situation of the feet. By so doing we run the risk of occasionally forcibly separating the placenta; besides, we have to introduce the hand much further than is necessary, since the knees are often found lying quite close to the os. As soon as the membranes are perforated, the hand can be passed on in search of the feet (Fig. 142). At this stage of the operation increased care is necessary to avoid anything like force;

and should a pain come on the hand must be kept perfectly flat and still, and rather pressed on the body of the child than on the uterus. If the pains be strong, much inconvenience may be felt from the compression; and, were the onward movement continued, or the hand even kept bent in the conical form in which it was introduced, rupture of the uterine walls might easily be caused. This is not likely to occur in the class of cases now under consideration, for it is chiefly when the waters have long escaped that the progress of the hand is a matter of difficulty. Valuable assistance may now be given by pressing the breech downwards from without, so as to bring the knees or feet more easily within the reach of the internal hand. Having arrived at the knees or feet, they may be seized between the fingers, and drawn downwards in the absence of a pain (Fig. 143). This will cause the fœtus to revolve on its axis, the breech will descend, and, at the same time, the ascent of the head may be assisted by the right hand from without. It is a question with many accoucheurs which part of the inferior extremities should be seized and brought down. Some recommend us to seize both feet, others prefer one only, while some advise the seizure of one or both knees. In a simple case of turning, before the escape of the waters, it does not much matter which of these plans is followed, since version is accomplished with the greatest ease by any one of them. The seizure of the knee, however, instead of the feet offers certain advantages which

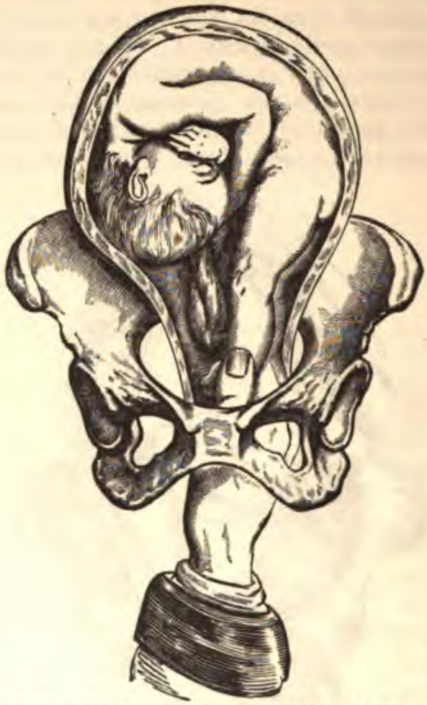
FIG. 142.



SEIZURE OF THE FEET WHEN THE HAND IS INTRODUCED INTO THE UTERUS.

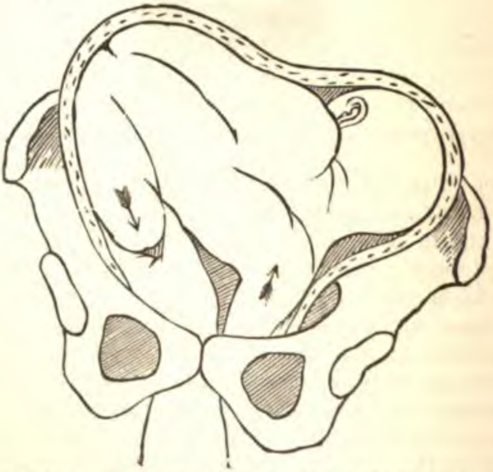
should not be overlooked. It is generally more accessible, affords a better hold (the fingers being inserted in the flexure of the ham), and,

FIG. 143.



DRAWING DOWN OF THE FEET, AND COMPLETION OF VERSION.

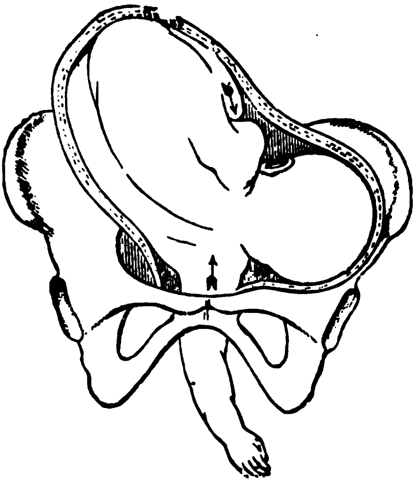
FIG. 144.



SHOWING THE ERROR OF ATTEMPTING TO TURN BY SEIZING THE LEG OF THE SAME SIDE AS THE PRESENTING SHOULDER.

being nearer the spine, traction acts more directly on the body of the child. Any danger of mistaking the knee for the elbow may be obviated by remembering the simple rule that the salient angle of the former looks towards the head of the child, of the latter towards its feet. Certain advantages may also be gained by bringing down one foot or knee only, instead of both. When one inferior extremity remains flexed on the body of the child, the part which has to pass through the os is larger than when both legs are drawn down, and consequently the os is more perfectly dilated, and less difficulty is likely to be experienced in the delivery of the rest of the body, so that the risk to the child is materially diminished. In arm presentation it is advisable to bring down, if possible, the knee farthest from and opposite to the presenting arm, for by this means the body is turned round on its own longitudinal axis, and the presenting arm or shoulder more easily withdrawn from the os. This point is well illustrated in the accompanying diagrams (Figs. 144 and 145) from Dr. Barnes's work, which show not only the error of drawing down the leg of the same side as the presenting arm, but the advantage to be derived from the opposite course.

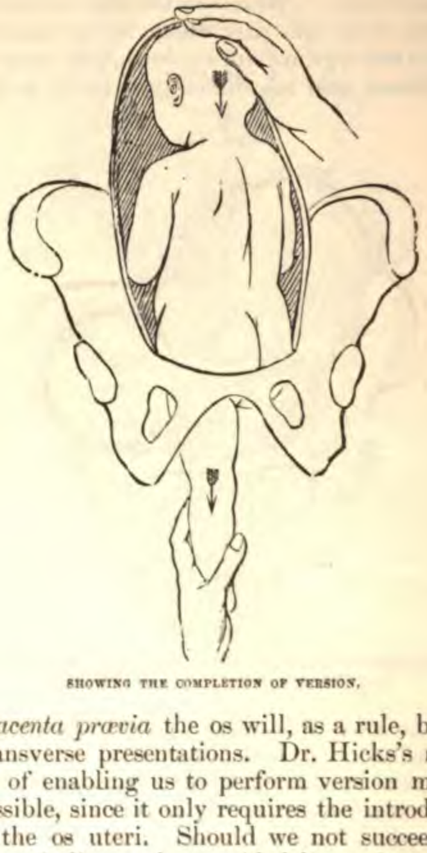
FIG. 145.



SHOWING THAT VERSION IS MOST READILY EFFECTED BY BRINGING DOWN THE KNEE OF THE OPPOSITE SIDE TO THAT OF THE PRESENTING SHOULDER.

Management after Version.—As soon as the head has reached the fundus, and the lower extremity is brought through the os, the case is converted into a foot or knee presentation, and it comes to be a question whether delivery should now be left to nature or terminated by art. This must depend to a certain extent on the case itself, and on the cause which necessitated version, but generally it will be advisable to finish delivery without unnecessary delay. To accomplish this, downward traction is made during the pains, and desisted from in the intervals (Fig. 146). As the umbilical cord appears, a loop should be drawn down; and if the hands be above the head, they must be disengaged and brought over the face, in the same manner as in an ordinary footling presentation. The management of the head, after it descends into the cavity of the pelvis, must also be conducted as in labors of that description.

Fig. 146.



SHOWING THE COMPLETION OF VERSION.

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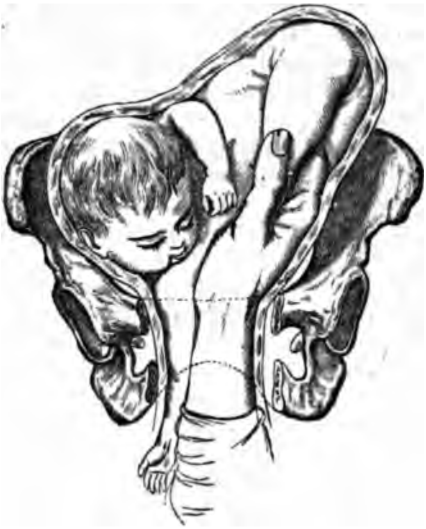
In *cases of placenta prævia* the os will, as a rule, be more easily dilated than in transverse presentations. Dr. Hicks's method offers the great advantage of enabling us to perform version much sooner than was formerly possible, since it only requires the introduction of one or two fingers into the os uteri. Should we not succeed by it, and the state of the patient indicates that rapid delivery is necessary, we have at our command, in the fluid dilators, a means of artificially dilating the os uteri which can be employed with ease and safety. If we have to do with a case of entire placental presentation, the hand should be passed at that point where the placenta seems to be least attached. This will always be better than attempting to perforate its substance, a measure sometimes recommended, but more easily performed in theory than in practice. If the placenta should only partially present, the hand should, of course, be inserted at its free border. It will frequently be advisable not to hasten delivery after the feet have been brought through the os, for they form of themselves a very efficient plug, and effectually prevent further loss of blood; while, if the patient be much exhausted, she may have her strength recruited by stimulants, etc., before the completion of delivery.

In *abdomino-anterior positions*, in which the waters have escaped, and in which, therefore, some difficulty may be reasonably anticipated, the operation is generally more easily performed with the patient on her back; the right hand is then introduced into the uterus, and the left employed externally (Fig. 147). In this way the internal hand has to be passed a shorter distance, and in a less constrained position. The operator then sits in front of the patient, who is supported at the edge of the bed in the lithotomy position with the thighs separated, and the right hand is passed up behind the pubis, and over the abdomen of the child.

FIG. 147.



SHOWING THE USE OF THE RIGHT HAND IN ABDOMINO-ANTERIOR POSITION.

The difficulties of turning culminate in those unfavorable cases of arm presentation in which the membranes have been long ruptured, the shoulder and arm pressed down into the pelvis, and the uterus contracted round the body of the child. The uterus being firmly and spasmodically contracted, the attempt to introduce the hand often only makes matters worse, by inducing more frequent and stronger pains. Even if the hand and arm be successfully passed, much difficulty is often experienced in causing the body of the child to rotate; for we have no longer the fluid medium present in which it floated and moved with ease, and the arm of the operator may be so cramped and pained, by the pressure of the uterine walls, as to be rendered almost powerless. The risk of laceration is also greatly increased, and the care necessary to avoid so serious an accident adds much to the difficulty of the operation.

Value of Anæsthesia in relaxing the Uterus.—In these perplexing cases various expedients have been tried to cause relaxation of the spasmodically contracted uterine fibres, such as copious venesection in the erect attitude until fainting is induced, warm baths, tartar emetic, and similar depressing agents. None of these, however, are so useful as the free administration of chloroform, which has practically superseded them all, and often answers most effectually when given to its full surgical extent.

Mode of Procedure.—The hand must be introduced with the precautions already described. If the arm be completely protruded into the vagina, we should pass the hand along it as a guide, and its palmar surface will at once indicate the position of the child's abdomen. No advantage is gained by amputation, or attempting to replace it, as is sometimes recommended. When the os is reached, the real difficulties of the operation commence, and, if the shoulder be firmly pressed down into the brim of the pelvis, it may not be easy to insinuate the hand past it. It is allowable to repress the presenting part a little, but with extreme caution, for fear of injuring the contracted uterine parietes. It is better to insinuate the hand past the obstruction, which can generally be done by patient and cautious endeavors. Having succeeded in passing the shoulder, the hand is to be pressed forwards in the intervals, being kept perfectly flat and still on the body of the fœtus when the pains come on. It is much safer to press on it than on the uterine walls, which might readily be lacerated by the projecting knuckles. When the hand has advanced sufficiently far, it will be better, for the reasons already mentioned, to seize and bring down one knee only, and that the one farthest from and opposite to the presenting shoulder.

Even when the foot has been seized and brought through the os, it is by no means always easy to make the child revolve on its axis, as the shoulder is often so firmly fixed in the pelvic brim as not to rise towards the fundus. Some assistance may be derived from pushing the head upwards from without, which of course would raise the shoulder along with it. If this should fail, we may effect our object by passing a noose of tape or wire ribbon round the limb which has been drawn through the os, by which traction is made downwards and backwards; at the same time, the other hand is passed into the vagina to displace the shoulder and push it out of the brim. It is evident that this cannot be done as long as the limb is held by the left hand, as there is no room for both hands to pass into the vagina at the same time. By this manœuvre version may be often completed, when the child has refused to turn in the ordinary way. Various instruments have been invented, both for passing a lac round the child's limb, and for repressing the shoulder, but none of them can compete, either in facility of use or safety, with the hand of the accoucheur.

Should all attempts at version fail, no resource is left but the mutilation of the child, either by evisceration or decapitation. This extreme measure is, fortunately, seldom necessary, as with due care version may generally be effected, even under the most unfavorable circumstances.

CHAPTER III.

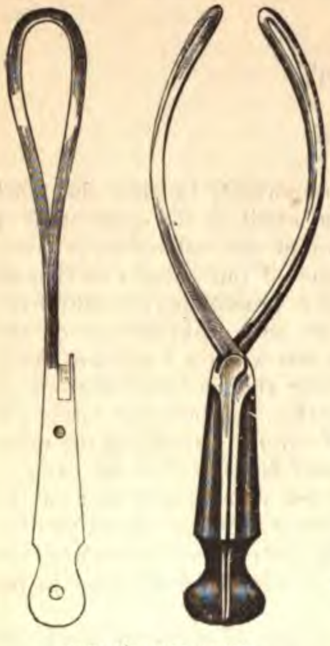
THE FORCEPS.

Of all obstetric operations the most important, because the most truly conservative both to the mother and child, is the application of the forceps. In modern midwifery the use of the instrument is much extended, and it is now applied by some of our most experienced accoucheurs with a frequency which older practitioners would have strongly reprobated. That the injudicious and unskilful use of the forceps is capable of doing much harm no one will for a moment deny. This, however, is not a reason for rejecting the recommendations of those who advise a more frequent resort to the operation, but rather for urging on the practitioner the necessity of carefully studying the manner of performing it, and of making himself familiar with the cases in which it is easy or the reverse. Nothing but practice—at first on the dummy and afterwards in actual cases—can impart the operative dexterity which it should be the aim of every obstetrician to acquire, and without which there can be no assurance of his doing his duty to his patient efficiently.

The forceps may best be described as a pair of artificial hands, by which the fœtal head may be grasped and drawn through the maternal passages by a *vis a fronte*, when the *vis a tergo* is deficient. This description will impress on the mind the important action of the instrument as a tractor, to which all its other powers are subservient. The forceps consist of two separate blades of a curved form, adapted to fit the child's head; a lock by which the blades are united after introduction; and handles which are grasped by the operator, and by means of which traction is made. It would be a wearisome and unsatisfactory task to dwell on all the modifications of the instrument which have been made, which are so numerous as to make it almost appear as if no one could practise midwifery with the least pretension to eminence, unless he has attached his name to a new variety of forceps.

The Short Forceps.—The original instrument, invented by the Chamberlaynes, may be looked upon as a type of the short straight forceps, which have been more employed than any other, and which, perhaps, find their best representative in the short forceps of Denman (Fig. 148). Indeed, the only essential difference between the two is the lock of the latter, originally invented by Smellie, which is so excellent that it has been adopted in all British forceps, and which, for facility of juncture, is much superior to either the French pivot or the German lock, while for firmness it is, for all practical purposes, as good as either. In this instrument the blades are 7, the handles 4¾ inches in length; the extremities of the blades are exactly 1 inch apart, and the space between them, at their widest part, is $2\frac{7}{8}$ inches. The blades measure $1\frac{3}{4}$ inches at their greatest breadth, and spring with a regular sweep directly from the lock, there being no shank. The blades, as in all forceps, are formed of the best and most highly tempered steel, to resist the strain to which they are occasionally subjected, and they are smoothed and rounded on their inner surface, to diminish the risk of injury to the scalp of the child.

FIG. 148.



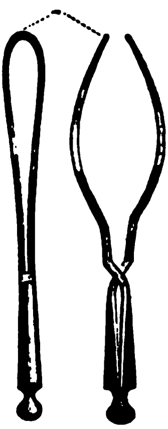
DENMAN'S SHORT FORCEPS.

The special advantage claimed for this form of instrument is, that, the two halves being precisely similar, no care or forethought is required on the part of the practitioner as to which blade should be introduced uppermost —an advantage of no great value, since no one should undertake a case of forceps delivery who has not sufficient knowledge of the operation, and presence of mind enough, to obviate any risk from the introduction of the wrong blade first. On account of its shortness, and the want of the second or pelvic curve, it is only adapted for cases in which the head is low down in the pelvis, or actually resting on the perinæum.

The question of the second or pelvic curve is one on which there is much difference of opinion. The forceps we are now considering, and the many modifications formed on the same plan, are constructed solely with reference to their grasp on the child's head, and without regard to the axes of the maternal passages into which they have to be passed, and through which they have to be drawn. Consequently, were we to introduce them when the head was at the upper part of the pelvis, we could not fail to expose the soft parts to the risk of contusion, and (in consequence of the necessity of drawing more directly backwards) unduly stretch and even lacerate the perinæum. Hence it is now admitted by obstetricians, with few exceptions, that the second curve is essential before the complete descent of the head, although it is not absolutely so after this has taken place. The only circumstances under which a straight blade can possess any superiority are in certain cases of occipito-posterior position, in which it is found necessary to rotate the head round a large extent of the pelvis, when the circular sweep of a strongly-curved instrument might prove injurious. Such cases, however, are of rare occurrence, and need in no way influence the general employment of the pelvic curve.

The short forceps, usually employed in Scotland, are the invention of the late Dr. Zeigler (Fig. 149), and are useful from the facility with which the blades may be introduced in accurate apposition to each other, a point which in practice is of no little value. In general size and appearance they closely resemble Denman's forceps, but the fenestra of the lower blade is continued down to the handle. In introducing, the lower blade is slipped over the handle of the other blade already *in situ*, and thus it is guided with great certainty into a proper position, locking itself as it passes on. This instrument has the disadvantage of not having the second curve, but the facility of introduction has rendered it a great favorite with many who have been in the habit of employing it.

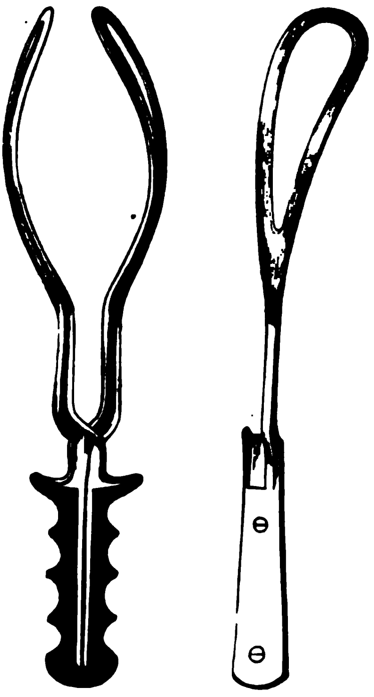
FIG. 149.



ZEIGLER'S FORCEPS.

The Long Forceps.—For cases in which the head is not on the perinæum, or at least not quite low in the pelvis, a longer instrument is essential. To meet this indication, Smellie invented the long forceps, which, like the shorter instrument, have been very variously modified. The most perfect instrument of the kind employed in this country is that known as Simpson's forceps (Fig. 150), which combine many excellent points selected from the forceps of various obstetricians, as well as some original additions, and which, as a whole, have never been surpassed. The curved portions of the blades are 6½ inches long, the fenestra measuring 1½ inches at its widest part. The extremities of the blades are 1 inch asunder when the handles are closed, and 3 inches at their widest part. The object of this somewhat unusual width is to lessen the compressing power of the instrument, without in any way interfering with its action as a tractor. The pelvic curve is less than in most long forceps, so as to admit of the rotation of the head when necessary, without the risk of injuring the maternal structures. Between the curve of the blade and the lock is a straight portion or shank, measuring 2⅜ inches, which, before joining the handle, is bent at right angles into a knee. This shank is a useful addition to all forceps, and is essential in long forceps to ensure the junction of the blades beyond the parts of the mother, which might otherwise be caught in the lock and injured. The knees serve the purpose of preventing the blades

FIG. 150.



SIMPSON'S FORCEPS.

from slipping from each other after they have been united. They also admit of one finger being introduced above the lock and used as an aid in traction; a provision which is made in some other varieties of long forceps by a semicircular bend in each shank. The handles, which in most British forceps are too small and smooth to afford a firm grasp, are serrated at the edge, and flattened from before backwards, so as to fit the closed fist more accurately. At their extremities, near the lock, there are a pair of projecting rests, over which the fore and middle fingers may be passed in traction, and which greatly increase our power over the instrument. Although this and other varieties of the long forceps are specially constructed for application when the head is high in the pelvis, they answer quite as well as the short forceps—indeed, in most respects better—when it has descended low down. It is a decided advantage for the practitioner to habituate himself to the use of one instrument, with the application and power of which he becomes thoroughly familiar. It is a mere waste of space and money for him to encumber himself with a number of instruments of various shapes and sizes; and he may be sure that a good pair of long forceps, such as Simpson's, will be suitable for every emergency, and in any position of the head.

The chief argument against the use of such an instrument in simple forceps cases is its great power. This, however, is entirely based on a misconception. The existence of power does not involve its use, and the stronger instrument can be employed with quite as much delicacy and gentleness as the weaker. The remarks of Dr. Hodge[1] on this point are extremely apposite, and are well worthy of quotation. He says, "Certainly no man ought to apply the forceps who has not sufficient discretion to use no more force than is absolutely requisite for safe delivery; if, therefore, there is more power at command he is not obliged to use it; while, on the contrary, if much power be demanded, he can, within the bounds of prudence, exercise it by the long forceps, but with the short forceps his efforts might be unavailing: moreover, in cases of difficulty, the short forceps being used, the practitioner would be forced to make great muscular efforts; while with the long forceps, owing to the great leverage, such effort will be comparatively trifling, and of course the whole force demanded can be much more delicately and at the same time efficiently applied, and with more safety to the tissues of the child and its parent."

Continental Forceps.—The forceps usually employed on the Continent, and in America, differ considerably, both in appearance and construction, from those in use in this country. As a rule they are larger and more powerful instruments, joined by a pivot or button joint, and they always possess the second or pelvic curve. Of late years Simpson's forceps have been much employed in some parts of Germany. The chief objection to the Continental instruments is their cumbrousness. This is chiefly in the handles, which in many of them are forged in a piece with the blades, the part introduced within the maternal structures not being materially different from the similar part of the English instrument.

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[1] System of Obstetrics, p. 242.

Action of the Instrument.—The forceps are generally said to act in three different ways:

1st. *As a tractor.*

2d. *As a lever.*

3d. *As a compressor.*

It is more especially as a tractor that the instrument is of value, and it is used with the greatest advantage when it is employed merely to supplement the action of the uterus, which is insufficient of itself to effect delivery, or when, from some complication, it is necessary to complete labor with greater rapidity than can be accomplished by the unaided powers of nature. In most cases traction alone is sufficient; but, in order that it may act satisfactorily, and that the instrument may not slip, a proper construction of the forceps, and a sufficient curvature of the blades, are essential. The want of these is the radical fault of many of the short straight instruments in common use, which have a tendency to slip during our efforts at extraction.

The forceps act also as a lever; but this action has been greatly exaggerated. They are generally described as a lever of the first class, the power being at the handles, the fulcrum at the lock, and the weight at the extremities. There may possibly be some leverage power of this kind when the instrument is first introduced, and the handles held so loosely that one blade is able to work on the other. But, as ordinarily used, the handles are held with a sufficiently firm grasp to prevent this movement, and then the two blades practically form a single instrument. A little consideration will show that when thus employed, they can only act as a lever of the second class; an action which is brought into play during the side-to-side movements which are generally used in conjunction with traction, the fulcrum being that portion of the head on which the extremities of the blades rest, the power being at the handles, and the weight between the two. This action is doubtless occasionally of value in assisting delivery; but it must always be subservient to direct traction.

Regarding the compressive power of the instrument there has been much difference of opinion. There is no doubt that the forceps, especially some of the foreign instruments in which the points nearly approach each other, are capable of exerting considerable compression on the head. It is, however, extremely problematical if this action be of real value. It is to be borne in mind that in cases of protracted labor the head has been already moulded and compressed, and the bones have been made to overlap each other to their utmost extent, by the sides of the pelvis; we can scarcely, therefore, expect to diminish the head much more by the forceps, without employing an amount of force that will seriously endanger the life of the child. It is in cases of disproportion between the head and the pelvis, depending on slight antero-posterior contraction of the pelvic brim, that diminution of the child's head by compression would be most useful. Then, however, the pressure of the forceps is exerted on that portion of the head which lies in the most roomy diameter of the pelvis, where there is no want of space. If this pressure do not increase the opposite diameter, which is in apposition to the narrowed portion of the pelvis, it can at least do nothing towards lessening it; and diminution of any other part of the child's head is not required.

Dynamical Action of the Forceps.—The mere introduction of the forceps sometimes excites increased uterine action, through the reflex irritation induced by the presence of a foreign body in the vagina. This has been called the dynamical action of the forceps; but it cannot be looked upon in any other light than that of an occasional accidental result.

The circumstances indicating the use of the forceps have been separately considered elsewhere, and to recapitulate them here would only lead to needless repetition. I shall therefore now merely describe the mode of using the instrument.

Before doing so, it is well to repeat what has already been said as to the difference between what may be termed the high and low forceps operations. The application of the instrument, when the head is low in the pelvis, is extremely simple; and when there is no disproportion between the head and the pelvis, and some slight traction is alone required to supplement deficient expulsive power, the operation, in the hands of any ordinarily well-instructed practitioner, ought to be perfectly safe both to the mother and child. It is very different when the head is arrested at the brim, or high in the pelvis. Then the application of the forceps is an operation requiring much dexterity for its proper performance, and must never be undertaken without anxious consideration. It is because these two classes of operations have been confused together, that the use of the instrument is regarded by many with such unreasonable dread.

Before attempting to introduce the forceps, there are several points to which attention should be directed:

1st. The membranes must, of course, be ruptured.

2dly. For the safe and easy application of the instrument, it is also advisable that the os should be fully dilated, and the cervix retracted over the head. Still, these two points cannot be regarded, as many have laid down, as being *sine qua non*. Indeed, we are often compelled to use the instrument when, although the os is fully dilated, the rim of the cervix can be felt at some point of the contour of the head, especially in cases in which the anterior lip is jammed between the head and the pelvic wall. Provided due care be taken to guard the cervical rim with the fingers of one hand, as the instrument is slipped past it, there need be no fear of injury from this cause. If the os be not fully dilated, but is sufficiently so to admit of the passage of the forceps, the operation, under urgent circumstances, may be quite justifiable, although it must necessarily be a somewhat anxious one.

3dly. The position of the head should be accurately ascertained, by means of the sutures and fontanelles. Unless this be done, the operation must always be hap-hazard and unsatisfactory, as the practitioner can never be in possession of accurate knowledge of the progress of the case. It may be that the occiput is directed backwards; and, although that does not necessarily contra-indicate the application of the forceps, it involves special precautions being taken.

4thly. The bladder and bowels should be emptied.

As a rule, the lower blade, lightly grasped between the tips of the index and middle fingers and thumb, should be introduced first. Poised in this way, we have perfect command over it, and can appreciate in a moment any obstacle to its passage. Two or more fingers of the left hand are introduced into the vagina, and by the side of the head, as a guide; the greatest care must be taken, if the cervix be within reach, that they are passed within it, so as to avoid the possibility of injury.

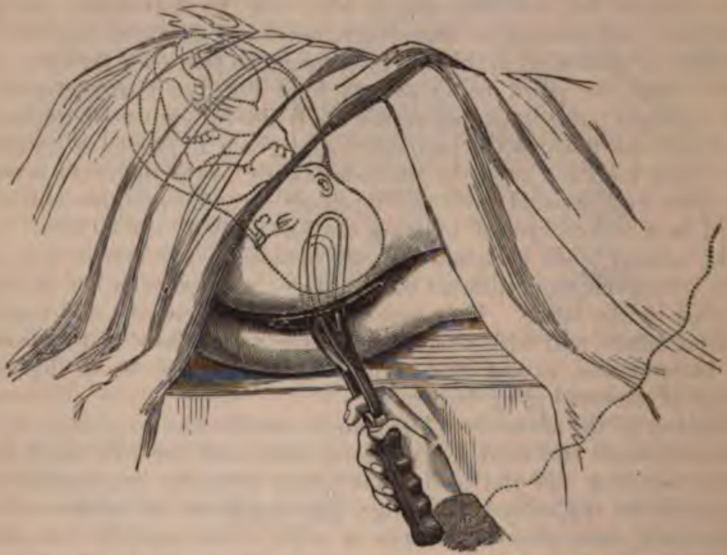
The handle of the instrument has to be elevated, and its point slid gently along the palmar surface of the guiding finger, until it touches the head (Fig. 151, *b*, *b*). At first the blade should be inserted in the axis of the outlet, but, as it progresses, the handle must be depressed and carried backwards. As it is pushed onwards it is made to progress by a slight side-to-side motion; and it is of the utmost importance to bear in mind that the greatest gentleness must always be used. If any obstruction be felt, we are bound to withdraw the instrument, partially or entirely, and attempt to manœuvre, not force, the point past it. As the blade is guided on in this way, it is made to pass over the convexity of the head, the point being always kept lightly in contact with it, until it finally gains its proper position. When fully inserted, the handle is drawn back towards the perinæum, and given in charge to an assistant. The insertion must be carried on only in the intervals between the pains, and desisted from during their occurrence; otherwise there would be a serious risk of injuring the soft parts of the mother.

The second blade is passed directly opposite to the first, and is generally somewhat more difficult to introduce, in consequence of the space occupied by the latter. It is passed along two fingers directly opposite the first blade, and with exactly the same precautions as to direction and introduction, except that at first its handle has to be depressed instead of elevated (Fig. 151, *a*, *a*).

Locking of the Handles.—The handle which was in charge of the assistant is now laid hold of by the operator, and the two handles are drawn together. If the blades have been properly introduced, there should be no difficulty in locking; but, should we be unable to join them easily, we must withdraw one or other, either partially or entirely, and re-introduce it with the same precautions as before. We must also assure ourselves that no hairs, or any of the maternal structures, are caught in the lock.

Method of Traction.—When once the blades are locked, we may commence our efforts at traction. To do this, we lay hold of the handles with the right hand, using only sufficient compression to give a firm grasp of the head and keep the blades from slipping. The left hand may be advantageously used in assisting and supporting the right during our efforts at extraction, and, at a late stage of the operation, may be employed in relaxing the perinæum when stretched by the head of the child. Traction must always be made in reference to the pelvic axes; being at first backwards towards the perinæum (Fig. 152), in the direction of the axis of the brim, and as the head descends and the vertex protrudes through the vulva, it must be changed to that of the outlet. We must extract only during the pains; and if these should be absent we must imitate them by acting at intervals. This is a point which deserves special attention; for there is no more common error than undue hurry in delivery. The only valid objection I know of against a more frequent resort to the forceps in lingering labors is, that the sudden emptying of the uterus, in the absence of pains, may predispose to hemorrhage; and it cannot be denied that it is one of some weight. However, if due care be taken to operate slowly, and to allow several minutes to elapse between each tractive effort, while at the same time uterine contractions are stimulated by pressure and support, this need not be considered a contra-indication. Besides direct traction, we may impart to the instrument a gentle waving motion from handle to handle, which brings into operation its power as a lever; but this must not be done to any great extent, and must always be subservient to direct traction.

FIG. 152.

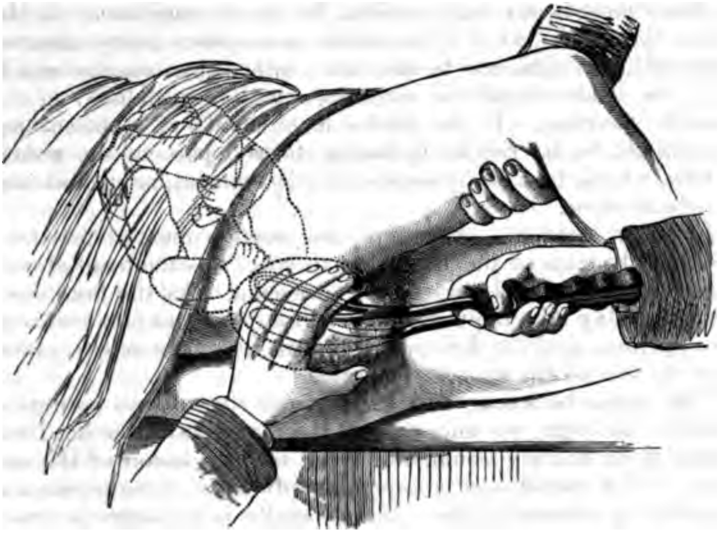


FORCEPS IN POSITION. TRACTION IN THE AXIS OF BRIM, DOWNWARDS AND BACKWARDS.

Descent of the Head.—Proceeding thus in a slow and cautious manner, carefully regulating the force employed according to the exigencies of the case, we shall perceive that the head begins to descend; and its progress should be determined from time to time, by the fingers of the unemployed hand.

When the head lies in the oblique diameter, as it descends, in consequence of its perfect adaptation to the pelvic cavity, it will turn into the antero-posterior diameter without any effort on the part of the operator, provided only that the traction be sufficiently slow and gradual. As the head is about to emerge, it is necessary to raise the handles towards the mother's abdomen. More than usual care is required to prevent laceration of the perinæum, which is always much stretched (Fig. 153). If, as often happens, the pains have now increased, and the perinæum be very thin and tense, it may even be desirable to remove the blades gently, and leave the case to be terminated by the natural powers; but if due precautions are used this will not be necessary.

FIG 153.



LAST STAGE OF EXTRACTION. THE HANDLES OF THE FORCEPS TURNED UPWARDS TOWARDS THE MOTHER'S ABDOMEN.

The peculiarities of forceps delivery in occipito-posterior positions have already been discussed (p. 289), and need not be repeated.

High Forceps Operations.—When the high forceps operation has been decided on, the passage of the blades will be found to be much more difficult, from the height of the presenting part, the distance which they must pass, and, in some cases, from the mobility of the head interfering with their accurate adaptation. The general principles of introduction and of traction are, however, identical. If the operation be attempted before the head has entered the pelvic brim, it must be fixed, as much as possible, by abdominal pressure. In guiding the blades to the head, special care must be taken to avoid any injury of the soft parts, especially if the cervix be not completely out of reach. For this purpose it may even be advisable to introduce the entire left hand as a guide, so as to avoid any possibility of injuring the cervix, from not passing the instrument under its edge.

Peculiar Method of introducing the Blades.—Some authors advise that in such cases the blade should be introduced at first opposite the sacrum, until the point approaches its promontory. It is then made to sweep round the pelvis, under the protecting fingers, till it reaches its proper position on the head. This plan is advocated by Ramsbotham, Hall Davis, and other eminent practical accoucheurs, and it is certainly of service in some cases of difficulty; especially when, from any reason, it is not possible to draw the nates over the edge of the bed, when the necessary depression of the handle of the upper blade is difficult to effect. It involves, however, a somewhat complicated manœuvre, and it is seldom that the blades cannot be readily introduced in the usual way.

Necessity of Care in Locking.—In locking, the slightest approach to roughness must be carefully avoided, for the extremities of the blades are now within the cavity of the uterus, and serious injury might easily be inflicted. If difficulty be met with, rather than employ any force, one of the blades should be withdrawn, and re-introduced in a more favorable direction. If the blades have shanks of sufficient length, there should be no risk of including the soft parts of the mother in the lock, which, in a badly-constructed instrument, is an accident not unlikely to occur.

Method of Traction.—After junction, traction must at first be altogether in the axis of the brim, and to effect this the handles must be pressed well backwards towards the perinæum. As the head descends it will probably take the usual turn of itself, without effort on the part of the operator, and the direction of the tractive force may be gradually altered to that of the axis of the outlet.

If the pains be strong and regular, and there be no indication for immediate delivery, we may remove the forceps after the head has descended upon the perinæum, and leave the conclusion of the case to nature. This course may be especially advisable if the perinæum and soft parts be unusually rigid; but generally it is better to terminate the labor without removing the instrument.

Possible Dangers of Forceps Delivery.—Before concluding this subject, reference may be made to the possible dangers of the operation. I would here again insist on the importance of distinguishing between the high and low forceps operations, which have been so unfortunately and unfairly confounded. Reasons have already been given for rejecting the statistics of the risks attending forceps delivery in the latter class of cases (p. 315). A formidable catalogue of dangers, both to the mother and child, might easily be gathered from our standard works on obstetrics. Among the former the principal are lacerations of the uterus, vagina, and perinæum; rupture of varicose veins, giving rise to thrombus; pelvic abscess, from contusion of the soft parts; subsequent inflammation of the uterus or peritoneum; tearing asunder of the joints and symphyses; and even fracture of the pelvic bones. A careful analysis of these, such as has been so well made by Drs. Hicks and Phillips,[1] proves beyond doubt that the application of the instrument is not so much concerned in their production, as the protraction of the labor, and the neglect of the practitioner in not interfering sufficiently soon to prevent the occurrence of the evil consequences afterwards attributed to the operation itself. Many of these will be found to arise from the prolonged pressure on the soft parts within the pelvis, and the subsequent inflammation or sloughing. To these causes may be referred with propriety most cases of vesico-vaginal fistula (p. 395), peritonitis, and metritis following instrumental labor.

Lacerations and similar accidents may, however, result from an incautious use of the instrument. Slight lacerations of the mucous membrane of the vagina are probably far from uncommon. But if these cases were closely examined it would be found that the fault lay not in the instrument, but in the hand that used it. Either the blades were introduced without due regard to the axes of the pelvis, or they were pushed forwards with force and violence, or an instrument was employed unsuitable to the case (such as a short straight forceps when the head was high in the pelvis), or undue haste and force in delivery were used. It would be manifestly unfair to lay the blame of such results upon the forceps, which in the hands of a more judicious and experienced practitioner would have effected the desired object with perfect safety. The instrument is doubtless unsafe in the hands of any one who does not understand its use, just as the scalpel or amputating knife would be in the hands of a rash and inexperienced surgeon. The lesson to be learnt seems to be, clearly, not that the dangers should deter us from the use of the forceps, but that they should induce us to study more carefully the cases in which they are applicable, and the method of using them with safety.

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[1] Obst. Trans., vol. xiii.

Possible Risks to the Child.—The dangers to the child are, principally, lacerations of the integuments of the scalp and forehead; contusion of the face; partial, but temporary, paralysis of the face from pressure of the blade on the facial nerve; depression or fracture of the cranial bones; injury to the brain from undue pressure of the blades. These evils are of the rarest possible occurrence, and, when they do happen, generally result from improper management of the operation—such as undue compression, the use of improper instruments, or excessive and ill-directed efforts at traction—and cannot, therefore, be considered inherent defects of the instrument. Many of the more common results, such as slight abrasions of the scalp, or paralysis of the face, are transitory in their nature, and of no real consequence; and the possibility of their occurrence cannot be considered as in any way contra-indicating an operation otherwise called for.

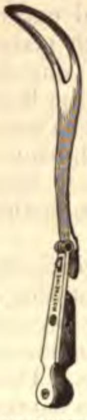
CHAPTER IV.

THE VECTIS.—THE FILLET.

IN connection with the subject of instrumental delivery it is essential to say something of the use of the *vectis*, on account of the value which was formerly ascribed to it, which was at one time so great in this country that it became the favorite instrument in the metropolis; Denman saying of it that even those who employed the forceps were "very willing to admit the equal, if not superior, utility and convenience of the vectis." Even at the present day there are practitioners of no small practical experience who believe it to be of occasional great utility, and use it in preference to the forceps in cases in which slight assistance only is required. In spite, however, of occasional attempts to recommend its use, the instrument has fallen into disfavor, and may be said to be practically obsolete.

The vectis, in its most approved form, consists of a single blade, not unlike that of a short straight forceps, attached to a wooden handle. A variety of modifications exist in its shape and size. The handle has been occasionally manufactured, for the convenience of carriage, with a hinge close to the commencement of the blade (Fig. 154), or with a screw at the point where the handle and blade join. The power of the instrument, and the facility of introduction, depend very much on the amount of curvature of the blade. If this be decided, a firmer hold of the head is taken and greater tractive force is obtained, but the difficulty of introduction is increased.

FIG. 154.



VECTIS WITH HINGED HANDLE.

The vectis is used either as a lever or a tractor. When employed in the former way, the fulcrum is intended to be the hand of the operator; but the risk of using the maternal structures as a *point d'appui*, and the inevitable danger of contusion and laceration which must follow, constitute one of the chief objections to the operation. Its value as a tractor must always be limited, and quite inferior to that of the forceps, while it is as difficult to introduce and manipulate.

Cases in which it is applicable.—The vectis has been recommended in cases in which the low forceps operation is suitable, provided the pains have not entirely ceased. There is no doubt that it may be quite capable of overcoming a slight impediment to the passage of the head. It is passed over various parts of the head, most commonly over the occiput, in the same manner, and with the same precautions, as one blade of the forceps. Dr. Ramsbotham says, "we shall find it necessary to apply it to different parts of the cranium, and perhaps the face also, successively, in order to relieve the head from its fixed condition, and favor its descent." Such an operation obviously requires quite as much dexterity as the forceps; while, if we bear in mind its comparatively slight effect, and the possible risk of injury to the maternal structures, we must admit that the disuse of the instrument in modern practice is amply justified.

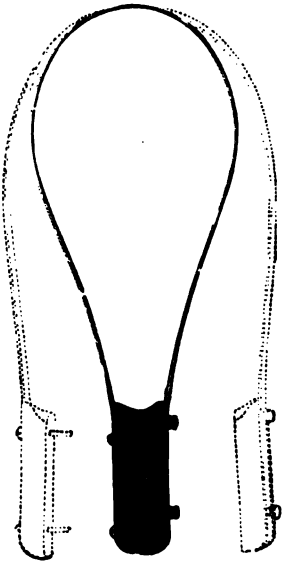
The vectis may, however, find a useful application when employed to rectify malpositions, especially in certain cases of difficult occipito-posterior presentations. This action of the instrument has already been considered (p. 289), and under such circumstances it may prove of service where the forceps is inapplicable. When so employed, it is passed carefully over the occiput, and, while the maternal structures are guarded from injury, downward traction is made during the continuance of a pain. So used, its application is perfectly simple and free from danger, and for this purpose it may be retained as a part of the obstetric armamentarium.

The *fillet* is the oldest of obstetric instruments, having been frequently employed before the invention of [illegible]eps, and even in the time of

Smellie it was much used in the metropolis. It has since completely fallen out of favor as a scientific instrument, although its use is every now and again advocated, and it is certainly a favorite instrument with some practitioners. This is to be explained by the apparent simplicity of the operation, and the fact that it can generally be performed without the knowledge of the patient, the latter, however, being one strong reason why it should not be used.

The fillet consists, in its most improved form—that which is recommended by Dr. Eardley Wilmot[1] (Fig. 155)—of a slip of whalebone fixed into a handle, composed of two separate halves, which join into one. The whalebone loop is slipped over either the occiput or face, and used as a tractor.

FIG. 155.



WILMOT'S FILLET.

Objections to its Use.—When applied over the face, after the head has rotated, it would probably do no harm; but if it were so placed when the head was high in the pelvis, traction would necessarily produce extension of the chin before the proper time, and would then interfere with the natural mechanism of delivery. If placed over the occiput, it would be impossible to make traction in the direction of the pelvic axes, as the instrument would then infallibly slip. If traction be made in any other direction, there must be a risk of injuring the maternal structures, or of changing the position of the head. Hence there is every reason for discarding the fillet as a tractor, or as a substitute for the forceps, even in the simplest cases.

It is quite possible that it may find a useful application in certain cases in which the vectis may also be used, viz., as a rectifier of malposition; and, from the comparative facility of its introduction, it would probably be the preferable instrument of the two.

[1] Obst. Trans., vol. xv.

CHAPTER V.

OPERATIONS INVOLVING DESTRUCTION OF THE FŒTUS.

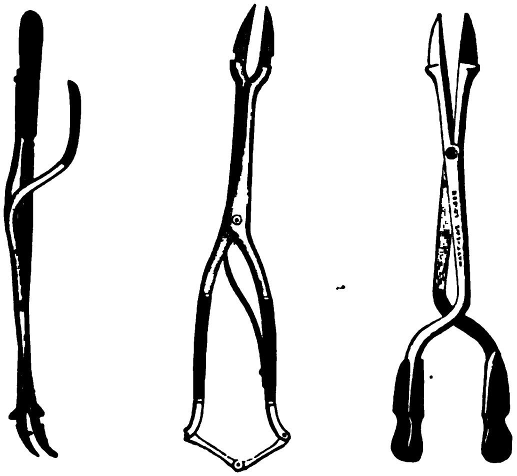
OPERATIONS involving the destruction and mutilation of the child were among the first practised in midwifery. Craniotomy was evidently known in the time of Hippocrates, as he mentions a mode of extracting the head by means of hooks. Celsus describes a similar operation, and was acquainted with the manner of extracting a fœtus in transverse presentations by decapitation; similar procedures were also practised and described by Aetius and others among the ancient writers. The physicians of the Arabian school not only employed perforators for opening the head, but were acquainted with instruments for compressing and extracting it.

Religious Objections to Craniotomy.—Until the end of the seventeenth century this class of operations was not considered justifiable in the case of living children; it then came to be discussed whether the life of the child might not be sacrificed to save that of the mother. It was authoritatively ruled by the Theological Faculty of Paris that the destruction of the child in any case was mortal sin. "Si l'on ne peut tirer l'enfant sans le tuer, on ne peut sans péché mortel le tirer." This dictum of the Roman Church had great influence on Continental midwifery, more especially in France, where, up to a recent date, the leading obstetricians considered craniotomy to be only justifiable when the death of the fœtus had been positively ascertained. Even at the present day there are not wanting practitioners who, in their praiseworthy objection to the destruction of a living child, counsel delay until the child has died; a practice thoroughly illogical, and only sparing the operator's feelings at the cost of greatly increased risk to the mother. In England, the safety of the child has always been considered subservient to that of the mother; and it has been admitted that, in every case in which the extraction of a living fœtus by any of the ordinary means is impossible, its mutilation is perfectly justifiable.

It must be admitted, however, that the frequency with which craniotomy has been performed in this country constitutes a great blot on British midwifery. During the mastership of Dr. Labbat, at the Rotunda Hospital, the forceps were never once applied in 21,867 labors. Even in the time of Clarke and Collins, when the frequency of craniotomy was much diminished, it was performed three or four times as often as forceps delivery. These figures indicate a destruction of fœtal life which we cannot look back to without a shudder, and which, it is to be feared, justify the reproaches which our Continental brethren have cast upon our practice. Fortunately, professional opinion has now completely recognized the sacred duty of saving the infant's life, whenever it is practicable to do so; and it may justly be said that British obstetricians now teach as carefully as those of any other nation the imperative necessity of using every endeavor to avoid the destruction of the fœtus.

Division of the Subject.—The operation now under consideration may be necessary: 1st, when the head requires either to be simply perforated, or afterwards more completely broken up and extracted—an operation which has received various names, but is generally known in this country as *craniotomy*, and which may or may not require to be followed by farther diminution of the trunk. 2dly, when the arm presents, and turning is impossible; this necessitates one of two procedures, *decapitation* with the separate extraction of the body and head, or *evisceration*. In both classes of case similar instruments are employed; and those generally in use at the present time may be first briefly described.

FIGS. 156, 157, 158.



VARIOUS FORMS OF PERFORATORS.

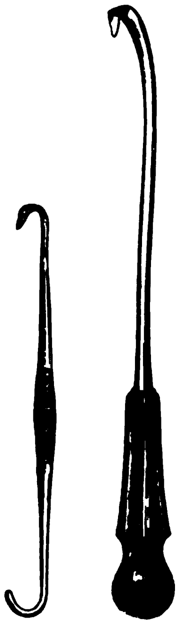
1. The object of the *perforator* is to pierce the skull of the child, so as to admit of the brain being broken up, and the consequent collapse and diminution in size of the cranium. The perforator invented by Denman, or some modification of it, has been principally employed. It requires the handles to be separated in order to open the blades, and this cannot be done by the operator himself. This difficulty is overcome in the modification of Naegele's perforator used in Edinburgh, in which the handles are so constructed that they open the points when pressed together, and are separated by a steel rod, with a joint at its centre, to prevent their opening too soon. By this arrangement the instrument can be manipulated by one hand only. The sharp-pointed portion has an external cutting edge, with projecting shoulders at its base, to prevent its penetrating too far into the cranium. Many modifications of these arrangements have since been contrived (Figs. 156, 157, 158). In

some parts of the Continent and America a perforator is used constructed on the principle of the trephine; but this is vastly more difficult to work, and has the great disadvantage of simply boring a hole in the skull, instead of splitting it up, as is done by the sharp-pointed instrument.

The instruments for extraction are the *crotchet* and the *craniotomy forceps*.

The crotchet is a sharp-pointed hook of highly-tempered steel, which is fixed on some portion of the skull, either internal or external, traction being made by the handle. The shank of the instrument is either straight or curved (Figs. 159 and 160), the latter being preferable, and it is either attached to a wooden handle or forged in a single piece of metal. A modification of this instrument is known as Oldham's vertebral hook. It consists of a slender hook, measuring, with its handle, 13 inches in length, which is passed through the foramen magnum, and fixed in the vertebral canal, so as to secure a firm hold for traction. All forms of crotchets are open to the serious objection of being liable to slip, or break through the bone to which they are fixed, so wounding either the soft parts of the mother, or the fingers of the operator placed as a guard. Hence they are discountenanced by most recent writers, and may with propriety be regarded as obsolete instruments.

FIGS. 159, 160.

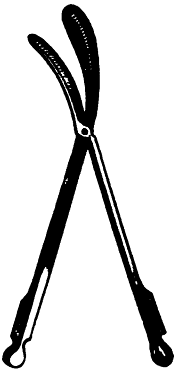


CROTCHETS.

Their place as tractors is well supplied by the more modern craniotomy forceps (Fig. 161). These are intended to lay hold of the skull, one blade being introduced within the cranium, the other externally, and, when a firm grasp has been obtained, downward traction is made. A second object they fulfil is, to break away and remove portions of the skull, when perforation and traction alone are insufficient to effect delivery. Many forms of craniotomy forceps are in use, some armed with formidable teeth, others, of simpler construction, depending on their roughened and serrated internal surfaces for firmness of grasp. For general use, there is no better instrument than the so-called *cranioclast* of Sir James Simpson (Fig. 162), which admirably fulfils both these indications. It consists of two separate blades, fastened by a button joint. The extremities of the blades are of a duck-billed shape, and are sufficiently curved to allow of a firm grasp of the skull being taken; the upper blade is deeply grooved, to allow the lower to sink into it, and this gives the instrument great power in fracturing the cranial bones, when that is found to be necessary. It need not, however, be employed for the latter purpose, and the blades, being serrated on their under surface, form as perfect a pair of craniotomy forceps as any in ordinary use. Provided with it, we are spared the necessity of procuring a number of instruments for extraction.

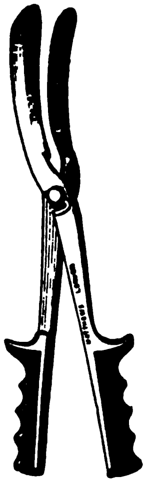
Amongst modern improvements in midwifery there are few which have led to more discussion than the use of the *cephalotribe*. This instrument, originally invented by Baudelocque, was long employed on the Continent before it was used in this country, the prejudice against it being no doubt due to its formidable size and appearance. Of late years many of our leading obstetricians have used it in preference either to the crotchet or craniotomy forceps, and have materially modified and improved its construction, so that the most objectionable features of the older instruments are now entirely removed.

FIG. 161.



CRANIOTOMY FORCEPS.

FIG. 162.



SIMPSON'S CRANIOCLAST.

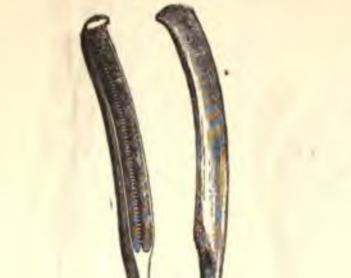
The cephalotribe consists of two powerful solid blades, which are applied to the head after perforation, and approximated by means of a screw so as to crush the cranial bones, and after this it may be also used for extraction. The peculiar value of the instrument is, that, when properly applied, it crushes the firm basis of the skull, which is left untouched by craniotomy, or, if it do not, it at least causes the base to turn edgeways within the blades, so as to place it in a more favorable position for extraction. Another and specially valuable property is, that it crushes the bones *within* the scalp, which forms a most efficient protective covering to their sharp edges; in this way one of the principal dangers of craniotomy, the wounding of the maternal passages by spiculæ of bone, is entirely avoided.

The cephalotribe, therefore, acts in two ways; as a crusher, and as a tractor. Some obstetricians believe the former to be its more important use, and even maintain that the cephalotribe is unsuited for traction. This view is specially maintained by Pajot, who teaches that after the size of the skull has been diminished by repeated crushings its expulsion should be left to the natural powers. There are some grounds for believing that in the greater degrees of obstruction the tractive power of the instrument is unsuited for use; but in the large majority of cases the facility with which the crushed head may be withdrawn by it constitutes one of its chief claims to the attention of the obstetrician. No one who has used it in this way, and experienced the rapid and easy manner in which it accomplishes delivery, can have any doubt on this point.

There is every reason to believe that cephalotripsy will be much extended in this country, and that it will be considered, as I believe it unquestionably deserves to be, the ordinary operation in cases requiring destruction of the fœtus. The comparative merits of cephalotripsy and craniotomy will be subsequently considered.

The most perfect cephalotribe is probably that known as Braxton Hicks's (Fig. 163), which is a modification of Simpson's. It is not of unwieldy size, but sufficiently powerful for any case, and not extravagant in price. The blades have a slight pelvic curve, which materially facilitates their introduction, yet not sufficiently marked to interfere with their being slightly rotated after application. Dr. Kidd, of Dublin, prefers a perfectly straight blade; while Dr. Matthews Duncan thinks it better to use a somewhat bulkier instrument, modelled on the type of the Continental cephalotribes. The principle of action of all these is identical, and their differences are really not of very material importance.

FIG. 163.



HICKS'S CEPHALOTRIBE.

Another mode of diminishing the fœtal skull is by removing it in sections. This is the principle embodied in the *forceps-saw* of Van Huevel, which consists of two large blades, not unlike those of the cephalotribe in appearance. Within these there is a complicated mechanism, working a chain-saw from below upwards, which cuts through the fœtal skull; the separated portions are subsequently withdrawn piecemeal. This instrument is very highly spoken of by the Belgian obstetricians who have used it, and who believe that it affords by far the safest and most effectual way of reducing the bulk of the fœtal skull. In this country it is practically unknown; and, although it must be admitted to be theoretically excellent, the exceeding complexity and cost of the apparatus have always stood in the way of its being used.

Dr. Barnes has suggested that the same object may be obtained by dividing the head with a strong wire *écraseur*. So far as I know, this suggestion has never yet been carried out in practice, not even by himself, and therefore it is not possible to say much about it. I should imagine, however, that there would be considerable difficulty in satisfactorily passing the loop of wire over the skull, in a pelvis in which there is any well-marked deformity.

Cases requiring Craniotomy.—The most common case for which craniotomy or cephalotripsy is performed, is a want of proper proportion between the head and the maternal passages. This may arise from a variety of causes. The most important, and that most often necessitating the operation, is osseous deformity. This may exist either in the brim, cavity, or outlet, and it is most often met with in the antero-posterior diameter of the brim. Obstetric authorities differ considerably as to the precise amount of contraction which will prevent the passage of a living child at term. Thus, Clarke and Burns believe that a living child cannot pass through a pelvis in which the antero-posterior diameter at the brim is less than 3¼ inches. Ramsbotham fixes the limit at 3 inches, and Osborne and Hamilton at 2¾ inches. The latter is the very extreme limit at which the birth of a living child is possible; but there can be no doubt that, under favorable circumstances, it may be possible to draw the fœtus, after turning, through a pelvis of that size. The opposite limit of the operation is still more open to discussion. Various authorities have considered it quite possible to draw a mutilated fœtus through a pelvis in which the antero-posterior diameter does not exceed 1½ inches, and, indeed, have succeeded in doing so. But then there must be a fair amount of space in the transverse diameter of the pelvis to admit of the necessary manipulations. If there be a clear space here of 3 inches and upwards, it is no doubt possible to deliver *per vias naturales;* but in such extreme deformities the difficulties of the operation are so great, and the bruising of the maternal structures so extensive, that it becomes an operation of the greatest possible severity, with results nearly as unfavorable to the mother as the Cæsarean section. Hence some Continental authorities have not scrupled to prefer the latter operation in the worst class of pelvic deformity. The rule in English practice always has been that craniotomy must be performed whenever it is practicable; and there can be no doubt that it is the right one.

Limits of the Operation.—Between from 2¾ to 3 inches antero-posterior diameter in the one direction, and 1¾ inches in the other, may be said to be the limits of craniotomy, provided, in the latter case, there be a fair amount of space in the transverse diameter. The same limits may be laid down with regard to tumors or other sources of obstruction.

There are a few other conditions in which craniotomy is justifiable, independently of pelvic contraction, such as certain conditions of the soft parts which are supposed to render the passage of the head peculiarly dangerous to the mother. Among them may be mentioned swelling and inflammation of the vagina from the length of the previous labor, the presence of bands and cicatrices in the vagina, and occlusion and rigidity of the os. It is hardly too much to say that, with a proper use of the resources of midwifery, the destruction of a living fœtus for any of these conditions might be obviated. The most common of them is undoubtedly swelling of the soft parts causing impaction of the head; an occurrence which ought to be invariably prevented by a timely use of the forceps. Should interference unfortunately be delayed until impaction has actually taken place, doubtless no other resource but craniotomy would be left; but such cases, it is to be hoped, are now of rare occurrence in British practice. Undue rigidity of the os can be overcome by dilatation with the caoutchouc bags, or, in more serious cases, by incision, which would certainly be less perilous to the mother than dragging even a mutilated fœtus through the small and rigid aperture. In the case of bands and cicatrices in the vagina, dilatation or incision will generally suffice to remove the obstruction; but, even were this not so, here, as in excessive rigidity of the perinæum, it would be better that slight lacerations should take place than that the child should be killed.

Certain complications of labor are held to justify craniotomy, such as rupture of the uterus, convulsions, and hemorrhage. The application of the forceps or turning will generally answer our purpose equally well, especially as we have the means of dilating the os sufficiently to admit of one or other of them being performed, when the natural dilatation is not sufficient. Craniotomy in rupture of the uterus will also be rarely indicated, as we have seen that gastrotomy appears to afford a better chance to the mother in those cases in which the fœtus has partially or entirely escaped from the uterine cavity.

Want of proportion between the fœtus and the pelvis, depending on undue size of the head, either natural or the result of disease, may render the operation essential. In the former of these cases we shall generally have first attempted delivery with the forceps, and, if they have failed, there can be no doubt as to the propriety of at once lessening the bulk of the head by perforation.

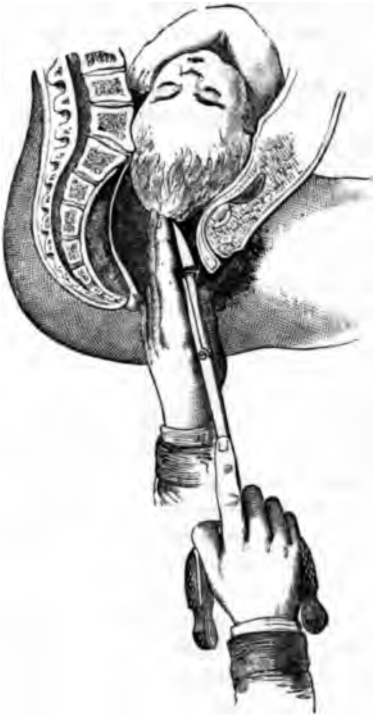
In most obstetric works we are recommended to perforate, rather than apply the forceps, when we are convinced that the child has ceased to live. This advice is based on the greater facility with which craniotomy can be performed, and its supposed greater safety to the mother. There can be no doubt of the ease with which the child can be extracted after perforation, when the pelvis is not contracted; and if we could always be sure of our diagnosis the rule might be a good one. Before acting on it, however, we must bear in mind the extreme difficulty of positively ascertaining the death of the fœtus. Of the signs usually relied on for this purpose, there are scarcely any which are not open to fallacy, except peeling of the scalp, and disintegration of the cranial bones (which do not take place unless the child has been dead for a length of time), and they are, therefore, useless in most instances. Discharge of the meconium constantly takes place when the child is alive; a cold and pulseless prolapsed cord may belong to a twin; and the fœtal heart may become temporarily inaudible, although the child is not dead. If, indeed, we have carefully watched the fœtal heart all through the labor, and heard it become more and more feeble, until at last it has stopped altogether, we might be certain that the child had died; but surely such observations would indicate an early recourse to the forceps or version, so as to obviate the fatal result we know to be impending.

In certain breech presentations, or after turning, it may be found impossible to extract the head, without diminishing its size by perforating behind the ear. In such cases we know to a certainty whether the child be alive or dead, before resorting to the operation.

The first step, whether we resort to cephalotripsy or craniotomy, is perforation, which may, therefore, be first described. In the former the necessity of first perforating the head is not always recognized. To endeavor to crush the head without perforating is needlessly to increase the difficulties of the case, and it should be remembered, as a cardinal rule, that perforation is an essential preliminary to the proper use of the cephalotribe.

When we desire to perforate, we must carefully ascertain the exact relation of the os to the presenting part, since in many cases the operation is performed before the os is fully dilated, and it is most essential to avoid all risk of wounding it. Two or more fingers of the left hand should be passed up to the head, and placed against the most prominent part of the parietal bone. Under these, used as a guard (Fig. 164), the perforator should be cautiously introduced until the scalp is reached. It is important to fix on a bony part of the skull, and not on a suture or fontanelle, for puncture, because our object is to break up the vault of the cranium as much as possible, so as to allow the skull to collapse. When the instrument has reached the point we have selected, it should be made to penetrate the scalp and skull with a semi-rotatory boring motion, and advanced until it has sunk up to the rests, which will oppose its further progress. Occasionally considerable force will be necessary to effect penetration, more especially if the scalp be swollen by long-continued pressure; and this stage of the operation will be facilitated by causing the assistant to steady the head by pressure through the abdomen, more especially if it be still free above the pelvic brim. We must then press together the handles of the instrument, which will have the effect of widely separating the cutting portion, and making an incision through the bones. After this the point should be turned round, and again opened at right angles to the former incision, so as to make a free crucial opening. During this process care must be taken to bury the perforator in the skull up to the rests, so as to avoid the possibility of injuring the maternal soft parts. The instrument should now be introduced within the skull and moved freely about, so as to thoroughly and completely destroy the brain. Especial care must be taken to reach the medulla oblongata and base of the brain; for if these were not destroyed we might subject ourselves to the distress of extracting a child in whom life was not extinct. If this part of the operation be thoroughly performed, there will be no necessity for washing out the brain by the injection of warm water, as is sometimes recommended, for the broken-up tissue will escape freely through the opening made by the perforator.

FIG. 164.



PERFORATION OF THE SKULL.

The perforation of the after-coming head does not generally offer any particular difficulty. It is accomplished in the same manner, the child's body being well drawn out of the way by an assistant. The point of the perforator, carefully guarded by the finger, is guided up to the occiput, or behind the ear, where it is inserted.

If there be no necessity for very rapid delivery, and the pains be still present, it is often advisable to wait ten minutes or a quarter of an hour before proceeding to extract. This delay will allow the skull to collapse and become moulded to the cavity of the pelvis, when forced down by the pains, and possibly the natural efforts may suffice to finish the labor in that time; or, at least, the head will have descended further, and will be in a better position for extraction. Should perforation be required after having failed to deliver with the forceps—and this is only likely to be the case when the obstruction is comparatively slight—it is certainly a good plan to perforate without removing the forceps, which may then be used as tractors.

We have now to decide on the method of extraction, and our choice lies between the cephalotribe and the craniotomy forceps.

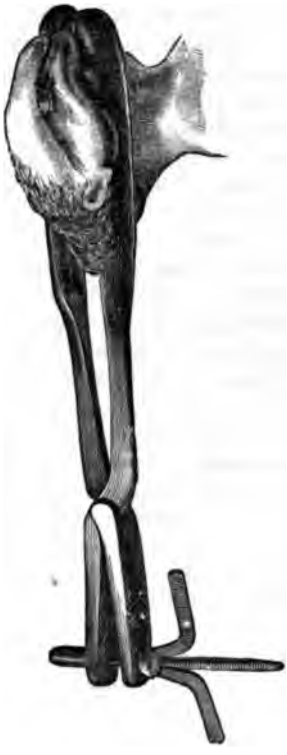
Those who have used both must, I think, admit that in any ordinary case, in which the obstruction is not great, and only a comparatively slight diminution in the size of the head is required, cephalotripsy is infinitely the easier operation. The facility with which the skull can be crushed, and extracted after crushing, is sometimes remarkable; and those who will take the trouble to read the reports of the operation published by Braxton Hicks, Kidd, and others, cannot fail to be struck with the rapidity with which the broken-down head may often be extracted. This is far from being the case with extraction by the craniotomy forceps, even when the obstruction is moderate only; for it may be necessary to use considerable traction, or the blades may take a proper grasp with difficulty, or it may be essential to break down and remove a considerable portion of the vault of the cranium before the head is lessened sufficiently to pass. During the latter process, however carefully performed, there is a certain risk of injuring the maternal structures, and, in the hands of a nervous or inexperienced operator, this danger, which is entirely avoided in cephalotripsy, is far from slight. The passage of the blades of the cephalotribe is by no means difficult, and I think it must be admitted that the possible risks attending it are comparatively small. On account, therefore, of its simplicity and safety to the maternal structures, I believe cephalotripsy to be decidedly the preferable operation in all cases of moderate obstruction.

When we approach the lower limit, and have to do with a very marked amount of pelvic deformity, the two operations stand on a more equal footing. Then the deformity may be so great as to render it difficult to pass the blades of even the smallest cephalotribe sufficiently deep to grasp the head firmly, and, even when they are passed, the space is often so limited as to impede the easy working of the instrument. Besides this, repeated crushings may be required to diminish the skull sufficiently. I attach but little importance to the argument that the diminution of the skull in one diameter increases its bulk in another. The necessity of removing and replacing the blades on another part of the skull, and repeating this perhaps several times, in the manner recommended by Pajot, is a far more serious objection. To do this in a contracted pelvis involves, of necessity, the risk of much contusion. Fortunately, cases of this kind are of extreme rarity, much more so than is generally believed, and when they do occur they tax the resources of the practitioner to the utmost.

On the whole, the conclusion I would be inclined to arrive at with regard to the two operations is, that in all ordinary cases cephalotripsy is safer and easier, whereas in cases with considerable pelvic deformity the advantages of cephalotripsy are not so well marked, and craniotomy may even prove to be preferable.

The first step in using the cephalotribe is the passage of the blades. These are to be inserted in precisely the same manner, and with the same precautions, as in the high forceps operation. In many cases the os is not fully dilated, and it is absolutely essential to pass the instrument within it. Special care should, therefore, be taken to avoid any injury to its edges, and, for this purpose, two or three fingers of the left hand, or even the whole hand, should be passed high up, so as thoroughly to protect the maternal structures. In order that the base of the skull may be reached and effectually crushed, the blades must be deeply inserted, and, in doing this, great care and gentleness must be used; as the projecting promontory of the sacrum generally tilts the head forwards, the handles of the instrument, after locking, must be well pressed back towards the perinæum. If the blades do not lock easily, or if any obstruction to their passage be experienced, one of them must be withdrawn and re-introduced, just as in forceps operations. Care must be taken to fix and steady the head by abdominal pressure as the instrument is being inserted, since it is generally far above the brim, and would readily recede if this precaution were neglected. When the blades are *in situ*, we proceed to crush by turning the screw slowly, and, as the blades are approximated, the bones yield, and the cephalotribe sinks into the cranium. The crushed portion then measures, of course, no more than the thickness of the blades—that is, about 1½ inches. This is necessarily accompanied by some bulging of the part of the cranium that is not within the grasp of the instrument (Fig. 165), but in slight contractions this is of no consequence, and we may proceed to extraction, waiting, if possible, for a pain, and drawing downwards in the axis of the pelvic outlet, as in forceps delivery. The site of perforation should be examined, to see whether spiculæ of bone are

FIG. 165.



FŒTAL HEAD CRUSHED BY THE CEPHALOTRIBE.

projecting from it, and if so they should be carefully removed. In such cases the head often descends at once, and with the greatest ease. Should it not do so, or should the obstruction be considerable, a quarter turn should be given to the handles of the instrument, so as to bring the crushed portion into the narrowed diameter, and the uncrushed portion into the wider transverse diameter. It may now be advisable to remove the blades carefully, and to re-introduce them with the same precautions, so as to crush the unbroken portion of the skull. This adds materially to the difficulties of the case, since the blades have a tendency to fall into the deep channel already made in the cranium, and so it is by no means always easy to seize the skull in a new direction. Before re-applying them, if the condition of the patient be good and pains be present, it may be well to wait an hour or more, in the hope of the head being moulded and pushed down into the pelvic cavity. This was the plan adopted by Dubois, and, according to Tarnier, was the secret of his great success in the operation. Pajot's method of repeated crushings, in the greater degrees of contraction, is based on the same idea, and he recommends that the instrument should be re-introduced at intervals of two, three, or four hours, according to the state of the patient, until the head is thoroughly crushed; no attempts at traction being used, and expulsion being left to the natural powers. This, he says, should always be done when the contraction is below 2½ inches, and he maintains that it is quite possible to effect delivery by this means when there are only 1½ inches in the antero-posterior diameter. The repeated introduction of the blades in this fashion must necessarily be hazardous, except in the hands of a very skilful operator; and I believe that if a second application fail to overcome the difficulty, which will only be very exceptionally the case, it would be better to resort to the measures presently to be described.

Should we elect to trust to the craniotomy forceps for extraction, one blade is to be introduced through the perforation, and the other, in apposition to it, on the outside of the scalp. In moderate deformities, traction applied during the pains may of itself suffice to bring down the head. Should the obstruction be too great to admit of this, it is necessary to break down and remove the vault of the cranium. For this purpose Simpson's cranioclast answers better than any other instrument. One of the blades is passed within the cranium, the other, if possible, between the scalp and the skull, and the portion of bone grasped between them is then broken off, which can generally be accomplished by a twisting motion of the wrist, without using much force. The separated portion of bone is then extracted, the greatest care being taken to guard the maternal structures, during its removal, by the fingers of the left hand. The instrument is then applied to a fresh part of the skull, and the same process repeated, until as much of the vault of the cranium as may be deemed necessary is broken up and removed.

Dr. Braxton Hicks, in a well-known paper on the best mode of extracting the head after perforation,[1] has conclusively shown that in difficult cases, after the removal of the cranial vault, the proper procedure is to bring down the face; since the smallest measurement of the skull, after the removal of the upper part of the cranium, is from the orbital ridge to the alveolar edge of the superior maxillary bone. This alteration in the presentation he proposes to effect by a small blunt hook, made for the purpose, which is forced into the orbit, by means of which the face is made to descend. Barnes recommends that this should be done by fixing the craniotomy forceps over the forehead and face, and making traction in a backward direction so as to get the face past the projecting promontory of the sacrum. The importance of bringing down the face was long ago pointed out by Hall and Burns, but it had been lost sight of until Hicks again drew attention to it in the paper referred to. In the class of cases in which this procedure is valuable, the risk to the maternal passages, from the removal of fractured portions of bone, must always be considerable, and it is of great importance not only to preserve the scalp as entire as possible, so as to protect them, but to use the utmost possible care in removing the broken pieces of bone.

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[1] Obst. Trans., vol. vii.

Extraction of the Body.—When the extraction of the head has been effected, either by the cephalotribe or the craniotomy forceps, there is seldom much difficulty with the body. By traction on the head one of the axillæ can easily be brought within reach, and, if the body do not readily pass, the blunt hook should be introduced, and traction made until the shoulder is delivered. The same can then be done with the other arm. If there be still difficulty, the cephalotribe may be used to crush the thorax. The body is, however, so compressible that this is rarely required.

There only remains for us to consider the second class of destructive operations. These may be necessary in long-neglected cases of arm presentation, in which turning is found to be impracticable. Here, fortunately, the question of killing the fœtus does not arise, since the child will, almost necessarily, have already perished from the continuous pressure. We have two operations to select from, *decapitation* and *evisceration.*

The former of these is an operation of great antiquity, having been fully described by Celsus. It consists in severing the neck, so as to separate the head from the body; the body is then withdrawn by means of the protruded arm, leaving the head in utero to be subsequently dealt with. If the neck can be reached without great difficulty—and in the majority of cases the shoulder is sufficiently pressed down into the pelvis to render this quite possible—there can be no doubt that it is much the simpler and safer operation.

The whole question rests on the possibility of dividing the neck. For this purpose many instruments have been invented. The one generally recommended in this country is known as Ramsbotham's hook, and consists of a sharply-curved hook, with an internal cutting edge. This is guided over the neck, which is divided by a sawing motion. There is often considerable difficulty in placing the instrument over the neck, although if this were done it would doubtless answer well. Others have invented instruments, based on the principle of the apparatus for plugging the nostrils, by means of which a spring is passed round the neck, and to the extremity of the spring a short cord, or the chain of an écraseur, is attached; the spring is then withdrawn, and brings the chain or cord into position. The objection to any of these apparatuses is, that they are unlikely to be at hand when required, for few practitioners provide themselves with costly instruments which they may never require. It is of importance, therefore, that we should have at our command some means of dividing the neck, which is available in the absence of any of these contrivances. Dubois recommends for this purpose a strong pair of blunt scissors. The neck is brought as low as possible by traction on the prolapsed arm, and the blades of the scissors guided carefully up to it. By a series of cautious snipping movements it is then completely divided from below upwards. This, if the neck be readily within reach, can generally be effected without any particular difficulty. Dr. Kidd, of Dublin,[1] who strongly advocates this operation, recommends that an ordinary male elastic catheter, strongly curved and mounted on a firm stilet, or, still better, on a uterine sound, should be passed round the neck. Previous to introduction a cord should be attached to the extremity of the catheter, which is left round the neck when it is withdrawn. By means of this cord a strong piece of whipcord, or the wire of an écraseur, can easily be drawn round the neck and used for dividing it. The former, to protect the maternal structures, may be worked through a speculum, and by a series of lateral movements the neck is easily severed. The écraseur, however, offers special advantages, since it entirely does away with any risk of injuring the mother.

After the neck is divided, the remainder of the operation is easy. The body is withdrawn without difficulty by the arm, and we then proceed to deliver the head. By abdominal pressure this, in most cases, can be pushed down into the pelvis, so as to come easily within reach of the cephalotribe, which is by far the best instrument for extraction. Preliminary perforation is not necessary, since the brain can escape through the severed vertebral canal. The secret of doing this easily is to fix and press down the head sufficiently from above; otherwise it would slip away from the grasp of the instrument. The perforator and craniotomy forceps may be used, if the cephalotribe be not at hand. Perforation is, however, by no means always easy, on account of the mobility of the head. After it is accomplished, one blade of the craniotomy forceps is passed within the skull, the other externally, and the head slowly drawn down.

Evisceration.—The alternative operation of evisceration is a much more troublesome and tedious procedure, and should only be used when the neck is inaccessible. The first step is to perforate the thorax at its most depending part, and make as wide an opening into it as possible, in order to gain access to its contents. Through this the thoracic viscera are removed piecemeal, being first broken up as much as possible by the perforator, and then, the diaphragm being penetrated, those in the abdomen. The object is to allow the body to collapse, and the pelvic extremities to descend, as in spontaneous evolution. This can be much facilitated by dividing the spinal column with a strong pair of scissors, introduced into the opening made in the thorax. Thus the body is doubled up as on a hinge, and its expulsion greatly facilitated. Here the crotchet may find a useful application, for it can be passed through the abdominal cavity and fixed on some point in the interior of the child's pelvis; and thus strong traction can be made without any risk of injury to the mother. It can be readily understood that this process is so lengthy and difficult as to render it probably the most trying of obstetric operations; it is certainly inferior in every respect to decapitation, and is only to be resorted to when that is impracticable.

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[1] Dublin Quart. Journ., May, 1871.

CHAPTER VI.

THE CÆSAREAN SECTION—SYMPHYSEOTOMY—AND GASTRO-ELYTROTOMY.

THE Cæsarean section has perhaps given rise to more discussion than any other subject connected with midwifery, and there is yet much difference of opinion as to the limits of, and indications for, the operation. The period at which the Cæsarean section was first resorted to is not known with accuracy. It seems to have been practised by the Greeks, after the death of the mother; and Pliny mentions that Scipio Africanus and Manlius were born in this way. The name of Cæsar is said to have been given to children so extracted, and afterwards to have been assumed as a family patronymic. These children were dedicated to Apollo; whence arose the practice of things sacred to that god being taken under the special protection of the family of the Cæsars. Many celebrities have been supposed to owe their lives to the operation; among the rest, Æsculapius, Julius Cæsar, and our own Edward VI. Regarding the two latter, there is conclusive proof that the tradition is without foundation. There is no doubt that the operation was constantly practised on women who had died at an advanced period of pregnancy, and, indeed it has, at various times, been enforced by law. Thus, among the Romans, it was decreed by Numa that no pregnant woman should be buried until the fœtus had been removed by abdominal section. The Italian laws also made it necessary, and the operation has always received the strong support of the Roman Church. So lately as the middle of the eighteenth century, the King of Sicily sentenced to death a physician who had neglected to practise it. The first authentic case in which the operation was performed on a living woman occurred in 1491. It was afterwards practised by Nufer in 1500; and in 1581 Rousset published a work on the subject, in which a number of successful cases were related. In English works of that time it is not alluded to, although it was undoubtedly performed on the Continent, and to such an extent that its abuse became almost proverbial.

We have evidence in Shakespeare, however, that the operation was familiarly known in this country, since he tells us that

> . . . . Macduff was from his mother's womb
> Untimely ripped.

Paré and Guillemeau, amongst the writers of the period, were noted for their hostility to the operation; while others equally strongly upheld it.

In this country it has scarcely ever been performed in a manner which offers even the faintest hope of success. It has been looked upon as almost necessarily fatal to the mother, and it has, therefore, been delayed until the patient has arrived at the utmost stage of exhaustion. For example, in looking over the records of British cases, it is no uncommon thing to find that Cæsarean section was resorted to, two, three, or even six days after labor had begun,[1] and when the patient was almost moribund. With rare exceptions within the last few years, the operation has been performed in what may be called a hap-hazard way. In many cases long and fruitless attempts at delivery by craniotomy had already been made, so that the passages had been subjected to much contusion and violence. Little or no attempt has been made to obviate the well-known risks of abdominal operations; no care has been taken to prevent blood and other fluids finding their way into the peritoneal cavity, and no means have been adopted subsequently to remove them. It is, therefore, not so much a matter of surprise that the mortality should have been so great, but rather that any cases at all should have recovered.

From what we know of the history of ovariotomy, its early fatality, and the extreme and even apparently exaggerated precautions which are essential to its success, it is fair to conclude that if the Cæsarean section were performed, as it is to be hoped it always will be in future, with the same careful attention to minute details as ovariotomy, the results would not be altogether so deadly. Making every allowance for these facts, it must be admitted that the Cæsarean section is necessarily almost a forlorn hope; and in making these observations I have no intention of contesting the well-established rule of British practice, that it is not admissible as an operation of election, and must only be resorted to when delivery *per vias naturales* is clearly impossible.

The mortality, as given in statistical returns from various sources, differs so greatly as to make them but little reliable. Radford tabulates 77 operations performed in this country, of which 66, or 85.71 per cent., proved fatal, and 11, or 14.28 per cent., recovered. Michaelis and Kayser found that out of 258 and 338 operations, 54 and 64 per cent. respectively were fatal. These include operations performed under all sorts of conditions, even when the patient was almost moribund; and until we are in possession of a sufficient number of cases performed under conditions showing that the result is obviously due to the operation—in which it was undertaken at an early period of labor, and performed with a reasonable amount of care—it is obviously impossible to arrive at any reliable conclusions as to the mortality of the operation. That it is necessarily hopeless is certainly not the case; and we know that on the Continent, where it is resorted to much oftener and earlier in labor than in this country, there are authentic cases in which it has been performed twice, thrice, and even, in one instance, four times, on the same patient. Kayser thinks that a second operation on the same patient affords a better prognosis than a first, probably because peritoneal adhesions, resulting from the first operation, have shut off the general abdominal cavity from the uterine wound; and he believes that in second operations the mortality is not more than 29 per cent.

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[1] See Radford on Cæsarean Section, p. 15.

Results to the Child.—The mortality of the children likewise cannot be ascertained from statistical returns, since in the large majority of cases in which dead children were extracted the result had nothing to do with the operation. Indeed, there is nothing in the operation itself which can reasonably be supposed to affect the child. If, therefore, the child be alive when the operation is commenced, there is every probability of its being extracted alive; and Radford's conclusion that "the risk to infants in Cæsarean births is not much greater than that which is contingent on natural labor, provided correct principles of practice are adopted," probably very nearly represents the truth.

Causes requiring the Operation.—The Cæsarean section is required when there is such defective proportion between the child and the maternal passages that even a mutilated fœtus cannot be extracted. This in by far the greatest number of cases is due to deformity of the pelvis arising from rickets or mollities ossium. The latter may occur in a patient who has been previously healthy, and who has given birth to living children. It is a more common cause of the extreme varieties of deformity than rickets; and out of 77 British cases, tabulated by Radford, in 43 the deformity was produced by osteo-malacia, and in 14 only by rickets. In certain cases the pelvis itself may be of normal size, but has its cavity obstructed by a solid tumor of the ovary, of the uterus itself, or one growing from the pelvic wall. The obstruction may also depend on morbid conditions of the maternal soft parts, of which the most common is advanced malignant disease of the cervix. Other conditions may, however, render it essential. Thus, Dr. Newman[1] records a case in which he performed the operation for insurmountable resistance and obstruction of the cervix, which was believed at the time to be malignant. The patient recovered, and was subsequently delivered naturally, and without anything abnormal being made out. This renders it probable that the disease was not malignant, and it may possibly have been an extensive inflammatory exudation into the tissues of the cervix, subsequently absorbed. I myself was present at a Cæsarean section performed in Calcutta in the year 1857, when the pelvis was so uniformly blocked up with exudation, probably due to extensive pelvic cellulitis or hæmatocele, that the operation was absolutely essential.

Different accoucheurs have fixed on various limits for the operation. Most British authorities are of opinion that it need not be resorted to if the smallest diameter of the pelvis exceed 1½ inches. This question has already been considered in discussing craniotomy, and it has been shown that a mutilated fœtus may be drawn through a pelvis of 1½ inches antero-posterior diameter, provided there be a space of 3 inches and upwards in the transverse diameter. If sufficient space for using the necessary instrument do not exist, the Cæsarean section may be absolutely required, even when there is a larger antero-posterior diameter than 1½ inches. This is especially likely to occur when we have to do with deformity arising from mollities ossium, in which the obstruction is in the sides and outlet of the pelvis, the true conjugate being even sometimes elongated. On the Continent the Cæsarean section is constantly practised, as an operation of election, when the smallest diameter measures from 2 to 2½ inches; and, when the child is positively known to be alive, some foreign authors recommend it when there are as much as 3 inches in the antero-posterior diameter. In this country, where the life of the child is most properly considered of secondary importance to the safety of the mother, we cannot fix one limit for the operation when the child is living, and another when it is dead. Nor, I think, can we admit the desire of the mother to run the risk rather than sacrifice the child, as a justification of the operation; although this is laid down as an indication by Schroeder.[1] Great as are the dangers attending craniotomy in extreme deformity, there can be no doubt that we must perform it whenever it is practicable, and only resort to the Cæsarean section when no other means of delivery are possible.

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[1] Obst. Trans., vol. viii. p. 343.

For this reason I think it unnecessary to discuss the question whether we are justified in destroying the fœtus in several successive pregnancies, when the mother knows that it is impossible for her to give birth to a living child. Denman was the first to question the advisability of repeating craniotomy on the same patient. Amongst modern authors Radford takes the most decided view on this point, and distinctly teaches that, even when delivery by craniotomy is possible, it "can be justified on no principle, and is only sanctioned by the dogma of the schools, or by usage," and that therefore the Cæsarean section should be performed, with the view of saving the child. Doubtless much can be said from this point of view; but, nevertheless, he would be a bold man who would deliberately elect to perform the Cæsarean section on such grounds. It is to be hoped, however, that in these days the induction of premature labor or abortion would always spare us the necessity of deciding so delicate a point.

Post-mortem Cæsarean Section.—The Cæsarean section may also be required in cases in which death has occurred during pregnancy or labor. This was the indication for which it was first employed, and it has constantly been performed when a pregnant woman has died at an advanced period of utero-gestation. There is no doubt that a prompt extraction of the child under these circumstances has frequently been the means of saving its life, but by no means so often as is generally supposed. Thus, Schwartz[2] showed that out of 107 cases in which it was employed not one living child was extracted. Villeneuve,[3] however, reports several successful cases, in 4 of which the operation was performed immediately after the mother's death, in 5 others at periods varying from ten minutes to half an hour.

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[1] Manual of Midwifery, p. 202.

[2] Monat. f. Geburt, suppl. vol., 1861, p. 121.

[3] Opérat. César. après la Mort, Paris, 1862.

The reason that the want of success has been so great, is doubtless the delay that must necessarily occur before the operation is resorted to; for, independently of the fact that the practitioner is seldom at hand at the moment of death, the very time necessary to assure ourselves that life is actually extinct will generally be sufficient to cause the death of the fœtus. Considering the intimate relations between the mother and child, we can scarcely expect vitality to remain in the latter more than a quarter, or, at the outside, half an hour, after it has ceased in the former. The recorded instances in which a living child was extracted ten, twelve, and even forty hours after death, were most probably cases in which the mother fell into a prolonged trance or swoon, during the continuance of which the child must have been removed. A few authentic cases, however, are known in which there can be no reasonable doubt that the operation was performed successfully several hours after the mother was actually dead. A well-known and interesting example is that of the Princess of Schwartzenburgh, who perished one evening in a fire at Paris, and from whose body a living infant is said to have been removed on the morning of the following day.

Since, then, there is a chance, however slight, of saving the child's life, we are bound to perform the operation, even when so much time has elapsed as to render the chances of success extremely small. It might be considered almost superfluous to insist on the necessity of assuring ourselves of the mother's death before commencing the necessary incisions; but, unfortunately, numerous instances are known in which mistakes in diagnosis have been made, and in which the first steps of the operation have shown that the mother was still alive. The operation should, therefore, always be performed with the same care and caution as if the mother were living. If death have occurred during labor, some have advised version as a preferable alternative. This can only be resorted to, with any hope of success, if the passages be in a condition to admit of delivery with rapidity; otherwise the delay required for dilatation, even when forcibly accomplished, and the drawing of the child through the pelvis, will be almost necessarily fatal. The only argument in favor of version is, that it is less painful to the friends; and, if they manifest a decided objection to the Cæsarean section, there can be no reason why an attempt to save the child in this way should not be made.

The *causes of death after the Cæsarean section* may, speaking generally, be classed under four principal heads; hemorrhage, peritonitis and metritis, shock, and septicæmia. These are pretty much the same as those following ovariotomy, and the resemblance between the two operations is so great that modern experience as to the best mode of performing ovariotomy, as well as regards the after-treatment, may be taken as a guide in the management of cases of Cæsarean section.

Hemorrhage to an alarming extent is a frequent complication, although seldom the cause of death. Thus, out of 88 operations, the particulars of which have been carefully noted, severe hemorrhage occurred in 14, 6 of which terminated successfully, and in 4 only could the fatal result be ascribed to the loss of blood. In one of these the source of the hemorrhage is not mentioned, in another it came from the wound in the abdominal wall, and in the other two, from the uterine incision being made directly over the placenta. In neither of the two latter was the loss of blood immediately fatal; for it was checked by uterine contraction, and only recurred after many hours had elapsed. The divided uterine sinuses, and the open mouths of the vessels at the placental site, are the most common sources of hemorrhage.

Much may be done to diminish the risk of bleeding, but, even with every precaution, it must be a source of danger. Hemorrhage from the abdominal wall may be best prevented by making the incision as nearly as possible in the line of the linea alba, so as not to wound the epigastric arteries, and by tying any bleeding vessels as we proceed. The principal loss of blood will be met with in dividing the uterus; and this will be greatest when the incision is near or over the placental site, where the largest vessels are met with. We are recommended to ascertain the position of the placenta by auscultation, and thus, if possible, to avoid opening the uterus near its insertion. But even if we admit the placental souffle to be a guide to its situation, if the placenta be attached to the anterior wall of the uterus, a knowledge of its position would not always enable us to avoid opening the uterus in its immediate vicinity. We must, in the event of its lying under the incision, rather hope to control the hemorrhage by removing it at once from its attachments, and rapidly emptying the uterus. When the child has been removed there may be a large escape of blood; but this will generally be stopped by the contraction of the uterus, in the same manner as after natural labor. Should contraction not take place, the uterus may be firmly grasped, for the purpose of exciting it. This plan is advocated by Winckel, who had a large experience in the operation; and by using free compression in this way, and making a point of not closing the wound until the uterus is firmly contracted, he has never met with any inconvenience from hemorrhage. If bleeding continue, styptic applications may be used, as in a case reported by Hicks, who was obliged to swab out the uterine cavity with a solution of perchloride of iron.

Peritonitis and Metritis.—Among the most frequent causes of death are peritonitis and metritis. Kayser attributes the fatal result to them in 77 out of 123 unsuccessful cases.

The mere division of the peritoneum will not account for the frequency of this complication, since its occurrence is considerably more frequent than after ovariotomy, in which the injury to the peritoneum is quite as great, and indeed greater, if we take into account the adhesions which have to be divided or torn in that operation.

The division of the uterus must be regarded as one source of this danger. Dr. West lays great stress on its unfavorable condition after delivery for reparative action. He believes that the process of involution or fatty degeneration which commences in the muscular fibres previous to delivery, renders them peculiarly unfitted to cicatrize; and he points out that, on post-mortem examination, the edges of the incision have been found dry, of unhealthy color, gaping, and showing no tendency to heal. On this account Hicks and others have operated ten days or more before the full period of labor, in the hope that the risk from this source might be avoided. It is by no means certain, however, that the change in the uterine fibres is the cause of the wound not healing, and involution will commence at once when the uterus is emptied, even if the full period of pregnancy have not arrived. As a point of ethics, moreover, it is questionable if we are justified in anticipating the date of so dangerous an operation, even by a few weeks, unless the benefit to be derived is very decided indeed.

One important cause of peritonitis is the escape of the lochia through the uterine incision into the cavity of the peritoneum, which there decompose and act as an unfailing source of irritation. This may be prevented, to a great extent, by seeing that the os uteri is patulous, so as to afford a channel for the escape of discharges, and by closing the uterine wound by sutures. In addition there is the danger arising from blood and liquor amnii escaping into the peritoneum, and subsequently decomposing. There is little evidence that "la toilette du péritoine," on which ovariotomists now lay so much stress, has ever been particularly attended to in Cæsarean operations.

The chief predisposing cause of these inflammations, however, must be looked for in the condition of the patient, just as asthenic inflammation in ovariotomy is most frequently met with in those whose general health is broken down by the long continuance of the disease. We are fully justified, therefore, in assuming that peritonitis and metritis will be more likely to occur after the Cæsarean section when that operation has been unnecessarily delayed, and when the patient is exhausted by a protracted labor. In proof of this we find that in the large proportion of the cases above mentioned, peritonitis occurred when the operation was performed under unfavorable conditions.

Septicæmia.—The sources of septicæmia are abundantly evident, not the least, probably, being absorption by the open vessels in the uterine incision.

Nervous Shock.—The last great danger is general shock to the nervous system. In Kayser's 123 cases, 30 of the deaths are referred to this cause. In the large majority of these the patient was profoundly exhausted before the operation was begun. It is in predisposing to these nervous complications that we should, *a priori*, expect that vacillation and delay would be most hurtful; and in operating when the patient's strength is still unimpaired, we afford her the best chance of bearing the inevitable shock of an operation of such magnitude.

Secondary Dangers.—In addition, a few cases have been lost from accidental complications, which are liable to occur after any serious operation, and which do not necessarily depend on the nature of the procedure.

There is only one source of danger, special to the child, which is worthy of attention. As the infant is being removed from the cavity of the uterus, the muscular parietes sometimes contract with great rapidity and force, so as to seize and retain some part of its body. This occurred in two of Dr. Radford's cases, and in one of them it is stated that "the child was vigorously alive when first taken hold of, but, from the length of time occupied in extracting the head, it became so enfeebled as to show only slight signs of life," and subsequently all attempts at resuscitation failed. I have myself seen the head caught in this way, and so forcibly retained that a second incision was required to release it. In Dr. Radford's cases the placenta happened to be immediately under the incision, and he attributes the inordinate and rapid contraction of the uterus to its premature separation. It is difficult to believe that this was more than a coincidence, because the contraction does not take place until the greater part of the child's body has been withdrawn, and because numerous cases are recorded in which the uterus was opened directly over the placenta, or in which it was lying loose and detached, in none of which this accident occurred. The true explanation may, I think, be found in the special irritability of the uterus in different cases.

Irrespective of the risk of portions of the child being caught and detained, rapid contraction is a distinct advantage, since the danger of hemorrhage is thereby much diminished. Serious consequences may be best avoided by removing, when practicable, the head and shoulders of the child first, or by employing both hands in extraction, one being placed near the head, the other seizing the feet. Either of these methods is preferable to the common practice of laying hold of the part that may chance to lie most conveniently near the line of incision. If this point were properly attended to, although the detention of the lower extremities might occasionally occur, the life of the child would not be imperilled.

The *preparation of the patient for the operation* should seriously occupy the attention of the practitioner; and this is the more essential, since almost all patients requiring the Cæsarean section are in a wretchedly debilitated condition. If the patient be not seen until she is actually in labor, of course this is out of the question. But this will rarely be the case, since the deformed condition of the patient must generally have attracted attention. Every possible means should be taken, therefore, when practicable, to improve the general health by abundance of simple and nourishing diet, plenty of fresh air, and suitable tonics (amongst which preparations of iron should occupy a prominent place), while the state of the secretions, the bowels, skin, and kidneys, should be specially attended to. Whenever it is possible, a large, airy apartment should be selected for the operation, which should never be done in a hospital, if other arrangements be practicable. These details may seem trivial and unnecessary; but to ensure success in so hazardous an undertaking, no care can be considered superfluous, and probably the want of attention to such points has had much to do with increasing the mortality.

The question arises whether we should operate before labor has commenced. By selecting our own time, as some have advised, we certainly have the advantage of operating under the most favorable conditions, instead of possibly hurriedly. There are, however, numerous advantages in waiting until spontaneous uterine action has commenced, which seem to me to more than counterbalance the advantages of choosing our own time. Prominent among these is the partial opening of the os uteri, so as to afford a channel for the escape of the lochia, and the certainty of active contraction in the uterus, to arrest hemorrhage. Barnes recommends that premature labor should be first induced, and then the operation performed. This seems to me to introduce a needless element of complexity; and, besides, in cases of great deformity it is by no means always easy to reach the cervix with the view of bringing on labor. All needful arrangements should be made, so as to avoid hurry and excitement when the operation is commenced, and we may then wait patiently until labor has fairly set in.

The operation itself is simple. The patient should be placed on a table, in a good light, and with the temperature of the room raised to about 65°. Chloroform has so frequently been followed by severe vomiting that it is probably better not to administer it. For the same reason Mr. Spencer Wells has long given up using it in ovariotomy, and finds that chloromethyl answers admirably. In one or two cases local anæsthesia has been used, by means of two spray producers acting simultaneously; and this plan, if the patient have sufficient fortitude to dispense with general anæsthesia, has the further advantage of stimulating the uterus to powerful contraction.

Description of the Operation.—The incision should be made as much as possible in the line of the linea alba, so as to avoid wounding the epigastric arteries. On account of the deformity, the configuration of the abdomen is often much altered; and some have advised that the incision should be made oblique or transverse, and on the most prominent part of the abdomen. The risk of hemorrhage being thus much increased, the practice is not to be recommended. The incision, commencing a little above the umbilicus, is carried down for about three inches below it. The skin and muscular fibres are carefully divided, layer by layer, until the shining surface of the peritoneum is reached; and any bleeding vessels should be secured as we proceed. A small opening is now made in the peritoneum, which should be laid open along the whole length of the incision, upon two fingers of the left hand introduced as a guide. Before incising the uterus, an assistant should carefully support it in a proper position, and push it forward by the hands placed on either side of the incision, so as to bring its surface into apposition with the external wound, and prevent the escape of the intestines. If we have reason to believe that the placenta is situated anteriorly, we may incise the uterus on one or other side; otherwise the line of incision should be as nearly as possible central. The substance of the uterus is next divided until the membranes are reached, which are punctured, and divided in the same way as the peritoneum. The uterine incision should be of the same length as that in the abdomen, and it should not be made too near the fundus; for not only is that part more vascular than the body of the uterus, but wounds in that situation are more apt to gape, and do not cicatrize so favorably. After the uterus is opened, Dr. Winckel recommends that the fingers of an assistant should be placed in the two terminal angles of the wound, so that the ends of the incision may be hooked up and brought into close apposition with the abdominal opening. By this means he prevents not only the escape of blood and liquor amnii into the cavity of the peritoneum, but also the protrusion of the abdominal viscera.

Removal of the Child.—The child should now be carefully removed, the head and shoulders being taken out (if possible) first; the placenta and membranes are afterwards extracted. Should the placenta be unfortunately found immediately under the incision, a considerable loss of blood is likely to take place, which can only be checked by removing it from its attachments, and concluding the operation as rapidly as possible.

As soon as the child and the secundines have been extracted, the sooner the uterus contracts the better. It will usually do so of itself; but should it remain lax and flabby, it should be pressed and stimulated by the hand. We are specially warned against handling the uterus by Ramsbotham and others; but there seems no valid reason why we should not restrain hemorrhage in this way, as after a natural labor. The intervention of the abdominal parietes, in their lax condition after delivery, can make very little difference between the two cases.

The advisability of closing the uterine wound by sutures is a mooted point. The balance of evidence is certainly in favor of this practice, as tending to prevent the escape of the lochia into the peritoneal cavity. Interrupted sutures of silver wire may be used, and cut short; or, as successfully practised by Spencer Wells, a continuous silk suture may be applied, one end being passed through the os into the vagina, by which it is subsequently withdrawn. Before closing the uterine wound one or two fingers should be passed through the cervix, to ensure its being patulous. A free escape of the lochia in this direction is of great consequence, and Winckel even advises the placing of a strip of lint, soaked in oil, in the os, so as to keep up a free exit for the discharge.

A point of great importance, and not sufficiently insisted on, is the advisability of not closing the abdominal wound until we are thoroughly satisfied that hemorrhage is completely stopped, since any escape of blood into the peritoneum would very materially lessen the chances of recovery. In a successful case reported by Dr. Newman,[1] the wound was not closed for nearly an hour. Before doing so, all blood and discharges should be carefully removed from the peritoneal cavity, by clean soft sponges dipped in warm water. The abdominal wound should be closed from above downwards, by harelip pins, wire, or silk sutures, which should be inserted at a distance of an inch from each other, and passed entirely through the abdominal walls and the peritoneum, at some little distance from the edge of the incision, so as to bring the two surfaces of the peritoneum into contact. By this means we ensure the closure of the peritoneal cavity, the opposed surfaces adhering with great rapidity. The surface of the wound is then covered with pads of folded lint, kept in position by long strips of adhesive plaster, and the whole covered with a soft flannel belt.

Into the subsequent treatment it is unnecessary to enter at any length, since it must be regulated by general principles, each symptom being met as it arises. It has been customary to administer opiates freely after the operation; but they seem to have a tendency to produce sickness and vomiting, and ought not to be exhibited unless pain or peritonitis indicate that they are required. In fact, the treatment should in no way differ from that usual after ovariotomy, and the principles that should guide us will be best shown by the following quotation from

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[1] Obst. Trans., vol. viii.

Mr. Spencer Wells's description of that operation:—"The principles of after-treatment are—to secure extreme quiet, comfortable warmth, and perfectly clean linen to the patient; to relieve pain by warm applications to the abdomen, and by opiate enemas; to give stimulants when they are called for by failing pulse or other signs of exhaustion; to relieve sickness by ice, or iced drinks; and to allow plain, simple, but nourishing food. The catheter must be used every six or eight hours, until the patient can move without pain. The sutures are removed on the third day, unless tympanitic distension of the stomach or intestines endanger reopening of the wound. In such circumstances they may be left for some days longer. The superficial sutures may remain until union seems quite firm."

Bearing in mind the great mortality attending the Cæsarean section, it is not surprising that obstetricians should have anxiously considered the possibility of devising a substitute which should afford the mother a better chance of recovery. The first proposal of the kind was one from which great results were at first anticipated. In 1768, Sigault, then a student of medicine in Paris, suggested *symphyseotomy*, which consists in the division of the symphysis pubis, with the view of allowing the pubic bones to separate sufficiently to admit of the passage of the child. Although at first strongly opposed, it was subsequently ardently advocated by many obstetricians, and was often performed on the Continent, and in a few cases in this country.

It is generally admitted that it is quite impossible to make this a substitute for the Cæsarean section, since the utmost gain which even a wide separation of the symphysis pubis would give would be altogether insufficient to admit of the passage of even a mutilated fœtus. Dr. Churchill concludes that, even if it were possible to separate the pubes to the extent of 4 inches, we should only have an increase of from 4 lines to ½ inch in the antero-posterior diameter, in which the obstruction is generally most marked. In the lesser degrees of deformity this might possibly be sufficient to allow the fœtus to pass; but the risk of the operation itself, and the subsequent ill effects, altogether contra-indicate it in cases of this description.

A far more promising operation is one which was originally suggested by Jorg and Ritgen in 1820, under the name of *Gastro-Elytrotomy*, but which, in the then defective state of abdominal surgery, scarcely received attention, and has not even been alluded to in any of our standard obstetric works. It has recently been reconsidered by Professor Thomas, of New York, in an excellent paper which is well worthy of study,[1] and he has actually performed it in a moribund patient, and extracted a living child.

In this operation it is proposed to divide the vagina at its juncture with the cervix, this being reached by an incision extending from the symphysis pubis to the anterior-superior spine of the ilium. The loosely-attached peritoneum is then raised up, and the child removed through the os uteri by turning, and extracted through the opening in the abdomen. It must be at once apparent that the chief dangers of the Cæsarean section are obviated; for the peritoneal cavity is not opened (and, therefore, the risk of peritonitis is much lessened), there is no escape of blood into the peritoneum, and the uterus itself is not incised. The operation, as described and performed by Thomas, is as follows:

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[1] Amer. Journ. of Obst., vol. iii.

1st. An incision is made extending from the symphysis pubis to the anterior-superior spine of the ilium, dividing the thickness of the abdominal walls until the peritoneum is reached.

2d. The peritoneum is lifted up by means of the fingers, or by metal retractors, so as to admit of the juncture of the vagina and uterus being reached. So far the operation is precisely that which is practised by surgeons for the ligature of the iliac arteries, and offers no particular difficulties.

3d. The vagina is made to protrude in the wound by means of a metal sound, introduced through the vulva, and divided to a sufficient extent.

4th. This will allow the cervix to be reached, and it is drawn into the iliac fossa by a blunt hook passed into it, while the fundus uteri is depressed by an assistant in an opposite direction. If the os uteri be sufficiently open (and if possible it should have been previously dilated with caoutchouc bags), the hand is passed into the uterus, and the child removed by turning.

Dr. Thomas describes two cases in which he has performed this operation—one in the dead subject at the full period of pregnancy, and the other on a woman moribund from pneumonia. In the latter case the child was extracted alive; the mother was at the last gasp when the operation was performed, so that nothing can be said as to its effects on her. In neither was there the slightest difficulty experienced in any step of the operation.

No one who has seen much of ovariotomy could reasonably hold that there is anything in the procedure incompatible with success. Whether subsequent experience will justify the hopes that Dr. Thomas holds out, remains to be seen. Of course, all that can now be said of it is, that the operation is theoretically sufficiently simple, and that it offers a possible way of removing the child, without some of the gravest risks of the Cæsarean section. The greatest danger attending it seems to be that of hemorrhage, for there are large vessels at the upper part of the vagina which must be cut through. This would probably, however, be quite within the power of control, either by ligatures, or, as Thomas suggests, by passing a metallic speculum either through the abdominal wound or the vagina, and applying through it the actual cautery or the perchloride of iron. No difficulty need be anticipated in retracting the peritoneum to a sufficient extent, for in pregnancy that membrane is unusually ample, and much more loose in its attachments than in the non-pregnant state.

CHAPTER VII.

THE TRANSFUSION OF BLOOD.

THE transfusion of blood in desperate and apparently hopeless cases of hemorrhage, offers a possible means of rescuing the patient which merits careful consideration. It has again and again attracted the attention of the profession, but has never become popularized in obstetric practice. The reason of this is not so much the inherent defects of the operation itself—for quite a sufficient number of successful cases are recorded to make it certain that it is occasionally a most valuable remedy—but the fact that the operation has been considered a delicate and difficult one, and that it has been deemed necessary to employ complicated and expensive apparatus, which is never at hand when a sudden emergency arises. Whatever may be the difference of opinion about the value of transfusion, I think it must be admitted that it is of the utmost consequence to simplify the process in every possible way, and it is above all things necessary to show that the steps of the operation are such as can be readily performed by any ordinarily-qualified practitioner, and that the apparatus is so simple and portable as to make it easy for any obstetrician to have it at hand. There are comparatively few who would consider it worth while to carry about with them, in ordinary every-day work, cumbrous and expensive instruments which may never be required in a life-long practice; and hence it is not unlikely that, in many cases in which transfusion might have proved useful, the opportunity of using it has been allowed to slip. Of late years the operation has attracted much attention, the method of performing it has been greatly simplified, and I think it will be easy to prove that all the essential apparatus may be purchased for a few shillings, and in so portable a form as to take up little or no room, so that it may be always carried in the obstetric bag ready for any possible emergency.

The *history of the operation* is of considerable interest. In Villari's "Life of Savonarola" it is said to have been employed in the case of Pope Innocent VIII., in the year 1492; but I am not aware on what authority the statement is made. The first serious proposals for its performance do not seem to have been made until the latter half of the seventeenth century. It was first actually performed in France by Denis, of Montpellier, although Lower, of Oxford, had previously made experiments on animals, which satisfied him that it might be undertaken with success. In November, 1667, some months after Denis's case, he made a public experiment at Arundel House, in which twelve ounces of sheep's blood were injected into the veins of a healthy man, who is stated to have been very well after the operation, which must, therefore, have proved successful. These nearly simultaneous cases gave rise to a controversy as to priority of invention, which was long carried on with much bitterness.

The idea of resorting to transfusion after severe hemorrhage does not seem to have been then entertained. It was recommended as a means of treatment in various diseased states, or with the extravagant hope of imparting renewed life and vigor to the old and decrepit. The blood of the lower animals only was used; and, under these circumstances, it is not surprising that the operation, although practised on several occasions, was never established as it might have been had its indications been better understood.

From that time it fell almost entirely into oblivion, although experiments and suggestions as to its applicability were occasionally made, especially by Dr. Harwood, Professor of Anatomy at Cambridge, who published a thesis on the subject in the year 1785. He, however, never carried his suggestions into practice, and, like his predecessors, only proposed to employ blood taken from the lower animals. In the year 1824, Dr. Blundell published his well-known work entitled "Researches, Physiological and Pathological," which detailed a large number of experiments; and to that distinguished physician belongs the undoubted merit of having brought the subject prominently before the profession, and of pointing out the cases in which the operation might be performed with hopes of success. Since the publication of this work, transfusion has been regarded as a legitimate operation under special circumstances; but, although it has frequently been performed with success, and in spite of many interesting monographs on the subject, it has never become so established, as a general resource in suitable cases, as its advantages would seem to warrant. Within the last few years more attention has been paid to the subject, and the writings of Panum, Martin, and De Belina, abroad, and of Higginson, McDonnell, Hicks, and Aveling, at home, amongst many others, have thrown much light on many points connected with the operation; and it is to be hoped that the committee appointed by the Obstetrical Society, in their forthcoming Report, may still more increase our knowledge.

Nature and Object of the Operation.—Transfusion is practically only employed in cases of profuse hemorrhage connected with labor; although it has been suggested as possibly of value in certain other puerperal conditions, such as eclampsia, or puerperal fever. Theoretically it may be expected to be useful in such diseases; but, inasmuch as little or nothing is known of its practical effects in these diseased states, it is only possible here to discuss its use in cases of excessive hemorrhage. Its action is probably twofold. 1st, the actual restitution of blood which has been lost. 2d, the supply of a sufficient quantity of blood to stimulate the heart to contraction, and thus to enable the circulation to be carried on until fresh blood is formed. The influence of transfusion as a means of restoring lost blood must be trivial, since the quantity required to produce an effect is generally very small indeed, and never sufficient to counterbalance that which has been lost. Its stimulant action is no doubt of far more importance; and if the operation be performed before the vital energies are entirely exhausted, the effect is often most marked.

In the earliest operations the blood used was always that of the lower animals, generally of the sheep. Dr. Blundell believed that such blood could not be employed with success. Recent cases, such as those published by Keene, who used lamb's blood in 12 cases,[1] have conclusively proved this idea to be erroneous. Brown-Séquard has shown that Blundell's experiments with animal blood failed, partly because he used too large a quantity and injected too quickly, and partly because he used blood too rich in carbonic acid and too poor in oxygen. He has shown that the success of the operation must depend to a great extent on these points, and that blood containing sufficient carbonic acid to be black proves directly poisonous, unless it is injected in very small quantity and with great slowness. Although, then, it is certain that the blood of some of the lower animals, especially of those in which the corpuscles are of less size than in man, as in sheep, can be employed with safety, still, the operation of late years has been almost always performed with human blood alone, and, for many obvious reasons, is always likely to be so.

The great practical difficulty in transfusion has always been the coagulation of the blood very shortly after it has been removed from the body. When fresh-drawn blood is exposed to the atmosphere, the fibrine commences to solidify rapidly, generally in from three to four minutes, sometimes much sooner. It is obvious that the moment fibrination has commenced the blood is, *ipso facto*, unfitted for transfusion, not only because it can be no longer passed readily through the injecting apparatus, but because of the great danger of propelling small masses of solidified fibrine into the circulation, and thus causing embolism. Hence, if no attempt be made to prevent this difficulty, it is essential, no matter what apparatus is used, to hurry on the operation so as to inject before fibrination has begun. This is a fatal objection; for there is no operation in the whole range of surgery in which calmness and deliberation are so essential, the more so as the surroundings of the patient in these unfortunate cases are such as to tax the presence of mind and coolness of the practitioner and his assistants to the utmost.

All the recent improvements have had for their object the avoidance of coagulation; and practically this has been effected in one of three ways. 1st, by mediate transfusion from arm to arm, without allowing the blood to be exposed to the atmosphere, according to the method proposed by Aveling. 2d, by adding to the blood certain chemical reagents which have the property of preventing coagulation. 3d, removal of the fibrine entirely, by promoting its coagulation and straining the blood, so that the liquor sanguinis and blood corpuscles alone are injected.

Inasmuch as the success of the operation altogether depends on the method adopted, it will be well, before going further, to consider briefly the advantages and disadvantages of each of these plans.

1. The method of mediate transfusion has within the last few years been brought prominently before the profession by Dr. Aveling, who has invented an ingenious apparatus for performing it. It consists essentially of a miniature Higginson's syringe, without valves, and with a small silver canula at either end. One of these is inserted into

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[1] Lond. Med. Record, Dec. 31, 1873.

the vein of the person supplying the blood, the other into that of the patient, and by a peculiar manipulation of the syringe, subsequently to be described, the blood is carried from one vein into the other. It must be admitted that, if there were no practical difficulties, this instrument would be theoretically admirable, and it is therefore not surprising that it should have met with so much favor from the profession. I cannot but think, however, that the operation is not so simple as it at first sight appears, and that therefore it wants one of the essential elements required in any procedure for performing transfusion. One of my objections is, that it is by no means easy to work the apparatus without considerable practice. Of this I have satisfied myself by asking members of my class to work it after reading the printed directions, and finding that they are not always able to do so at once. Of course it may be said that it is easy to acquire the necessary manipulative skill, which it no doubt is; but, when the necessity for transfusion arises, there is no time left for practising with the instrument, and it is essential that an apparatus, to be universally applicable, should be capable of being used immediately and without previous experience. Other objections are the necessity of several assistants, the uncertainty of there being a sufficient circulation of blood in the veins of the donor to afford a constant supply, and the possibility of the whole apparatus being disturbed by restlessness or jactitation on the part of the patient. For these reasons, it seems to me that the plan of mediate transfusion is not so simple, nor so generally applicable, as defibrination. Still, it is impossible not to recognize its merits, and it is certainly well worthy of further study and investigation.

2. The second plan for obviating the bad effects of clotting is the addition of some substance to the blood which shall prevent coagulation. It is well known that several salts have this property, and the experiments made in the case of cholera patients prove that solutions of some of them may be injected into the venous system without injury. This method has been specially advocated by Dr. Braxton Hicks, who uses a solution of three ounces of fresh phosphate of soda in a pint of water, about six ounces of which are added to the quantity of blood to be injected. He has narrated 4 cases[1] in which this plan was adopted successfully, so far as the prevention of coagulation was concerned. It certainly enables the operation to be performed with deliberation and care, but it has the drawback of being somewhat complicated; and it may often happen that the necessary chemicals are not at hand. A further objection is the bulk of fluid which must be injected; and there is reason to believe that this has, in some cases, seriously embarrassed the heart's action, and interfered with the success of the operation. In many of the successful cases of transfusion the amount of blood injected has been very small, not more than two ounces. Dr. Richardson proposes to prevent coagulation by the addition of small quantities of liquor ammoniæ to the blood, in the proportion of two minims, diluted with twenty minims of water, to each ounce of blood.

3. The last method, and the one which, on the whole, I believe to be the simplest and most effectual, is defibrination. It has been chiefly

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[1] Guy's Hosp. Reports, vol. xiv.

practised in this country by Dr. McDonnell, of Dublin, who has published several very interesting cases in which he employed it, and abroad by Martin of Berlin, and De Belina of Paris. The process of removing the fibrine is simple in the extreme, and occupies a few minutes only. Another advantage is that the blood to be transfused may be prepared quietly in an adjoining apartment, so that the operation may be performed with the greatest calmness and deliberation, and the donor is spared the excitement and distress which the sight of the apparently moribund patient is apt to cause, and which, as Dr. Hicks has truly pointed out, may interfere with the free flow of blood. The researches of Panum, Brown-Séquard, and others, have conclusively proved that the blood corpuscles are the true vivifying element, and that defibrinated blood acts as well, in every respect, as that containing fibrine. It has been proved that the fibrine is reproduced within a short time,[1] and the whole tendency of modern research is to regard it, not as an essential element of the blood, but as an excrementitious product, resulting from the degradation of tissue, which may, therefore, be advantageously removed. Another advantage derived from defibrination is that the corpuscles are freely exposed to the atmosphere, oxygen is taken up, and carbonic acid given off, and the dangers which Brown-Séquard has shown to arise from the use of blood containing too much carbonic acid are thereby avoided. There can be, therefore, no physiological objection to removal of the fibrine, which, moreover, takes away all practical difficulty from the operation. The straining to which the defibrinated blood is subjected entirely prevents the possibility of even the most minute particle of fibrine being contained in the injected fluid; the risk from embolism is, therefore, less than in any of the other processes already referred to. My own experience of this plan is limited to a single case; but in that it answered so well that I can conceive of no reasonable objection to it. I should be inclined to say that transfusion, thus performed, is amongst the simplest of surgical operations—an opinion which the experience of McDonnell and others fully confirms.

Statistical Results.—The number of cases of transfusion is perhaps not sufficient to admit of completely reliable conclusions. It is certain, however, that transfusion has often been the means of rescuing the patient when apparently at the point of death, and after all other means of treatment had failed. Professor Martin records 57 cases, in 43 of which transfusion was completely successful, and in 7 temporarily so; while in the remaining 7 no reaction took place. Dr. Higginson, of Liverpool, has had 15 cases, 10 of which were successful. Figures such as these are encouraging, and they are sufficient to prove that the operation is one which at least offers a fair hope of success, and which no obstetrician would be justified in neglecting when the patient is sinking from the exhaustion of profuse hemorrhage. It is to be hoped also that further experience may prove it to be of value in other cases, in which its use has been suggested, but not, as yet, put to the test of experiment.

The possible risk of the operation would seem to be the danger of injecting minute particles of fibrine which form emboli, or bubbles of air, or of overwhelming the action of the heart by injecting too rapidly, or in too great quantity. These may be, to a great extent, prevented by careful attention to the proper performance of the operation, and it does not clearly appear, from the recorded cases, that they have ever proved fatal. We must also bear in mind that transfusion is seldom or never likely to be attempted until the patient is in a state which would otherwise almost certainly preclude the hope of recovery, and in which, therefore, much more hazardous proceedings would be fully justified.

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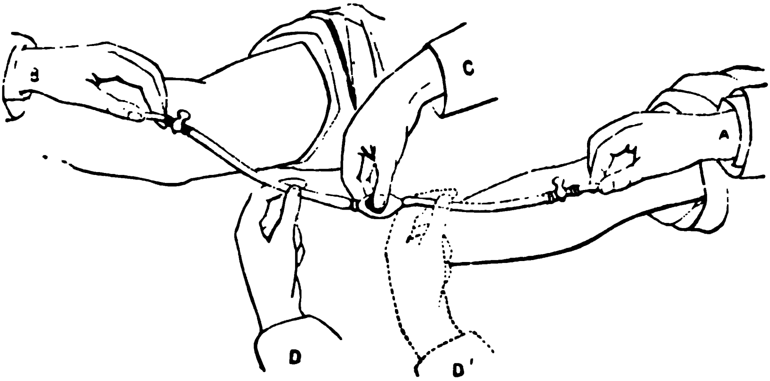
[1] Panum, Virchow's Arch., vol. xxvii.

The *cases suitable for transfusion* are those in which the patient is reduced to an extreme state of exhaustion from hemorrhage during or after labor or miscarriage, whether this is caused by the repeated losses of placenta prævia or the more sudden and profuse flooding of post-partum hemorrhage. The operation will not be contemplated until other and simpler means have been tried and failed, or until the symptoms indicate that life is on the verge of extinction. If the patient should be deadly pale and cold, with no pulse at the wrist, or one that is scarcely perceptible; if she be unable to swallow, or vomits incessantly; if she lie in an unconscious state; if jactitation, or convulsions, or repeated faintings should occur; if the respiration be laborious, or very rapid and sighing; if the pupil do not act under the influence of light; it is evident that she is in a condition of extreme danger, and it is under such circumstances that transfusion, performed sufficiently soon, offers a fair prospect of success. It does not necessarily follow because one or other of these symptoms is present that there is no chance of recovery under ordinary treatment, and indeed it is within the experience of all, that patients have rallied under apparently the most hopeless conditions. But when several of them occur together, the prospect of recovery is much diminished, and transfusion would then be fully justified, especially as there is no reason to think that a fatal result has ever been directly traced to its employment. Indeed, like most other obstetric operations, it is more likely to be postponed until too late to be of service, than to be employed too early, and in some of the cases reported as unsuccessful it was not performed until respiration had ceased and death had actually taken place. It has been sometimes said that transfusion can never be employed if the uterus be not firmly contracted, so as to prevent the injected blood again escaping through the uterine sinuses. The cases in which this is likely to occur are few; and if one were met with, the escape of blood could be prevented by the injection into the uterus of the perchloride of iron.

In describing the operation I shall limit myself to an account of Aveling's method of mediate transfusion, and to that of injecting defibrinated blood. I consider myself justified in omitting any account of the numerous complex apparatuses which have been invented for the purpose of injecting pure blood, since I believe the practical difficulties are too great ever to render this form of operation serviceable. The great objection to most of the instruments used is their cost and complexity; and as long as any special apparatus is considered essential, the full benefits to be derived from transfusion are not likely to be realized. The necessity for employing it arises suddenly; it may be in a locality in which it is impossible to procure a special instrument; and it would be well if it were understood that transfusion may be safely and effectually performed by the simplest means. In many of the successful cases an ordinary syringe was used; in one, in the absence of other instruments, a child's toy syringe was employed. I have myself performed it with a simple syringe purchased at the nearest chemist's shop, when a special transfusion apparatus failed to act satisfactorily.

Method of performing Mediate Transfusion.—In mediate transfusion (Fig. 166), the donor is seated close to the patient, and the veins in the arms of each having been opened, the silver canula at either end of the instrument is introduced into them (A B). The tube between the bulb and the patient is now pinched (D), so as to form a vacuum, and the bulb becomes filled with blood from the donor. The finger is now removed so as to compress the distal tube (D′), and the bulb being compressed (C), its contents are injected into the patient's vein. The bulb is calculated to hold about two drachms, so that the amount injected can be estimated by the number of times it is emptied. The risk of injecting air is prevented by filling the syringe with water, which is first injected before the blood.

FIG. 166.



METHOD OF TRANSFUSION BY AVELING'S APPARATUS.

Injection of Defibrinated Blood.—For injecting defibrinated blood various contrivances have been used. McDonnell's instrument is a simple cylinder with a nozzle attached, from which the blood is propelled by gravitation. When the propulsive power is insufficient, an increased pressure is applied by breathing forcibly into the open end of the receiver. De Belina's instrument is on the same principle, only atmospheric pressure is supplied by a contrivance similar to Richardson's spray producer, attached to one end. The idea is simple, but there is some doubt of a gravitation instrument being sufficiently powerful, and it certainly failed in my hands. I have had valves applied to Aveling's instrument, so that it works by compression of the bulb, like an ordinary Higginson's syringe. This, with a single silver canula at one end, for introduction into the vein, forms a perfect transfusion apparatus, taking up scarcely any space, and extremely inexpensive. If it be not at hand, any small syringe, with a tolerably fine nozzle, may be used.

Mode of preparing the Blood.—The first step of the operation is defibrination of the blood, which should, if possible, be prepared in an apartment adjoining the patient's. The blood to be injected should be taken from the arm of a strong and healthy man. The quality cannot be unimportant; and in some recorded cases the failure of the operation has been attributed to the fact of the emittent having been a weakly female. The supply from a woman might also prove insufficient; and, although it has been shown that blood from two or more persons may be used with safety, yet such a change necessarily causes delay, and should, if possible, be avoided. A vein having been opened, eight or ten ounces of blood are withdrawn, and received into some perfectly clean vessel, such as a dessert finger-glass. As it flows it should be briskly agitated with a clean silver fork, or a glass rod, and, very shortly, strings of fibrine begin to form. It is now strained through a piece of fine muslin previously dipped in hot water, into a second vessel which is floating in water at a temperature of about 105°. By this straining the fibrine and air-bubbles resulting from the agitation are removed, and, if there be no excessive hurry, it might be well to repeat the straining a second time. If the vessel be kept floating in the warm water, the blood is prevented from getting over-cool, and we can now proceed to prepare the arm of the patient for injection.

This is the most delicate and difficult part of the operation, since the veins are generally collapsed and empty, and by no means easy to find. The best way of exposing them is that practised by Mc Donnell, who pinches up a fold of the skin at the bend of the elbow, and transfixes it with a fine tenotomy knife or scalpel, so making a gaping wound in the integument, at the bottom of which the veins are seen lying. A probe should now be passed underneath the vein selected for opening, so as to avoid the chance of its being lost at any subsequent stage of the operation. This is a point of some importance; and from the neglect of this precaution I have been obliged to open another vein than that originally fixed on. A small portion of the vein being raised with the forceps, a nick is made into it for the passage of the canula.

Injection of the Blood.—The prepared blood is now brought to the bedside, and, the apparatus having been previously filled with blood to avoid the risk of injecting any bubbles of air, the canula is inserted into the opening made in the vein, and transfusion commenced. It should be constantly borne in mind that this part of the operation should be conducted with the greatest caution, the blood introduced very slowly, and the effect on the patient carefully watched. The injection may be proceeded with until some perceptible effect is produced, which will generally be a return of the pulsation, first at the heart and subsequently at the wrist, an increase in the temperature of the body, greater depth and frequency of the respirations, and a general appearance of returning animation about the countenance. Sometimes the arms have been thrown about, or spasmodic twitchings of the countenance have taken place. The quantity of blood required to produce these effects varies greatly, but in the majority of cases has been very small. Occasionally 2 ounces have proved sufficient; and the average may be taken as ranging between 4 and 6, although in a few cases between 10 and 20 have been used. The practical rule is to proceed very slowly with the injection until some perceptible result is observed. Should embarrassed or frequent respiration supervene, we may suspect that we have been injecting either too great a quantity of blood, or with too much force and rapidity, and the operation should at once be suspended, and not resumed until the suspicious symptoms have passed away. It may happen that the effects of the transfusion have been highly satisfactory, but that in the course of time evidence of returning syncope shows itself. This tendency may possibly be prevented by the administration of stimulants and general treatment; but if these fail there is no reason why a fresh supply of blood should not again be injected; but this should be done before the effects of the first transfusion have entirely passed away.

The subsequent effects in successful cases of transfusion merit careful study. In some few cases death is said to have happened within a few weeks with symptoms resembling pyæmia. Too little is known on this point, however, to justify any positive conclusions with regard to it.

PART V.

THE PUERPERAL STATE.

CHAPTER I.

THE PUERPERAL STATE AND ITS MANAGEMENT.

THE key to the management of women after labor, and to the proper understanding of the many important diseases which may then occur, is to be found in a study of the phenomena following delivery, and of the changes going on in the mother's system during the puerperal period. No doubt natural labor is a physiological and healthy function, and during recovery from its effects disease should not occur. It must not be forgotten, however, that none of our patients are under physiologically healthy conditions. The surroundings of the lying-in woman, the effects of civilization, of errors of diet, of defective cleanliness, of exposure to contagion, and of a hundred other conditions, which it is impossible to appreciate, have most important influences on the results of child-birth. Hence it follows that labor, even under the most favorable conditions, is attended with considerable risk.

The Mortality of Child-birth.—It is not easy to say with accuracy what is the precise mortality accompanying child-birth in ordinary domestic practice, since the returns derived from the reports of the Registrar-General, or from private sources, are manifestly open to serious error. The nearest approach to a reliable estimate is that made by Dr. Matthews Duncan,[1] who calculates, from figures derived from various sources, that not fewer than 1 out of every 120 women, delivered at or near the full time, dies within four weeks of child-birth. This indicates a mortality far above that which has been generally believed to accompany child-bearing under favorable circumstances. It, however, closely approximates to a similar estimate made by McClintock,[2] who calculates the mortality in England and Wales as 1 in 126, and in the upper and middle classes alone, where the conditions may naturally be supposed to be more favorable, as 1 in 146. In these calculations there are some obvious sources of error, since they include deaths from all causes within four weeks of delivery, some of which must have been independent of the puerperal state.

But it is not the deaths alone which should be considered. All practitioners know how large a number of their patients suffer from morbid states which may be directly traced to the effects of child-bearing. It is impossible to arrive at any statistical conclusion on this point; but it must have a very sensible and important influence on the health of child-bearing women.

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[1] "The Mortality of Childbed," Edin. Med. Journ., Nov. 1869.

[2] Dublin Quarterly Journ., Aug. 1869.

Alterations in the Blood after Delivery.—The state of the blood during pregnancy, already referred to, has an important bearing on the puerperal state. There is marked hyperinosis, which is largely increased by the changes going on immediately after the birth of the child; for then the large supply of blood which has been going to the uterus is suddenly stopped, and the system must also get rid of a quantity of effete matter thrown into the circulation in consequence of the degenerative changes occurring in the muscular fibres of the uterus. Hence all the depurative channels, by which this can be eliminated, are called on to act with great activity. If, in addition, the peculiar condition of the generative tract itself be borne in mind—viz., the large open vessels on its inner surface, the partially-bared inner surface of the uterus itself, and the channels for absorption existing in consequence of slight lacerations in the cervix or vagina—it is not a matter of surprise that septic diseases should be so common.

It will be well to consider successively the various changes going on after delivery, and then we shall be in a better position for studying the rational management of the puerperal state.

Nervous Shock.—Some degree of nervous shock or exhaustion is observable after most labors. In many cases it is entirely absent; in others it is well marked. Its amount is in proportion to the severity of the labor and the susceptibility of the patient; and it is, therefore, most likely to be excessive in women who have suffered greatly from pain, who have undergone much muscular exertion, or who have been weakened from undue loss of blood. It is evidenced by a feeling of exhaustion and fatigue, and not uncommonly there is some shivering, which soon passes off, and is generally followed by refreshing sleep. The extreme nervous susceptibility continues for a considerable time after delivery, and indicates the necessity of keeping the lying-in patient as free from all sources of excitement as possible.

Fall of the Pulse.—Immediately after delivery the pulse falls; and the importance of this, as indicating a favorable state of the patient, has already been alluded to. The condition of the pulse has been carefully studied by Blot,[1] who has shown that this diminution, which he believes to be connected with an increased tension in the arteries, due to the sudden arrest of the uterine circulation, continues, in a large proportion of cases, for a considerable number of days after delivery; and, as a matter of clinical import, as long as it does, the patient may be considered to be in a favorable state. In many instances the slowness of the pulse is remarkable, often sinking to 50 or even 40 beats per minute. Any increase above the normal rate, especially if at all continuous, should always be carefully noted, and looked on with suspicion. In connection with this subject, however, it must be remembered that in puerperal women the most trivial circumstances may cause a sudden

[1] Arch. Gén. de Méd., 1864.

rise of the pulse. This must be familiar to every practical obstetrician, who has constant opportunities of observing this effect after any transient excitement or fatigue. In lying-in hospitals it has generally been observed that the occurrence of any particularly bad case will send up the pulse of all the other patients who may have heard of it.

The *temperature in the lying-in state* affords much valuable information. During and for a short time after labor there is a slight elevation. It soon falls to, or even somewhat below, the normal level. Squire found that the fall occurred within 24 hours, sometimes within 12 hours, after the termination of labor.[1] For a few days there is often a slight increase of temperature, which is probably caused by the rapid oxidation of tissue in connection with the involution of the uterus. In about forty-eight hours there is a rise connected with the establishment of lactation, amounting to one or two degrees over the normal level; but this again subsides as soon as the milk is freely secreted. Credé has also shown[2] that rapid, but transient, rises of temperature may occur at any period, connected with trivial causes, such as constipation, errors of diet, or mental disturbances. But, if there be any rise of temperature which is at all continuous, especially to over 100° Fahr., and associated with rapidity of the pulse, there is reason to fear the existence of some complication.

The Secretions and Excretions.—The various secretions and excretions are carried on with increased activity after labor. The skin especially acts freely, the patient often sweating profusely. There is also an abundant secretion of urine, but not uncommonly a difficulty of voiding it, either on account of temporary paralysis of the neck of the bladder, resulting from the pressure to which it has been subjected, or from swelling and occlusion of the urethra. For the same reason the rectum is sluggish for a time, and constipation is not unfrequent. The appetite is generally indifferent, but the patient is often thirsty.

Secretion of Milk.—Generally in about forty-eight hours the secretion of milk becomes established, and this is occasionally accompanied by a certain amount of constitutional irritation. The breasts often become turgid, hot, and painful. There may, or may not, be some general disturbance, quickening of pulse, elevation of temperature, possibly slight shivering, and a general sense of oppression, which are quickly relieved as the milk is formed, and the breasts emptied by suckling. Squire says that the most constant phenomenon connected with the temperature is a slight elevation as the milk is secreted, rapidly falling when lactation is established. Barker noted elevation, either of temperature or pulse, in only 4 out of 52 cases which were carefully watched. There can be little doubt that the importance of the so-called "milk fever" has been immensely exaggerated, and its existence as a normal accompaniment of the puerperal state is more than doubtful. It is certain, however, that in a small minority of cases there is an appreciable amount of disturbance about the time that the milk is formed. Many modern writers, such as Winckel, Grundewaldt, and D'Espine, entirely deny the connection of this disturbance with lactation, and refer it to a slight and transient septicæmia. Graily Hewitt remarks that it is most commonly met with when the patient is kept low and on deficient diet after delivery, especially when the system is below par from hemorrhage or any other cause. This observation will, no doubt, account for the comparative rarity of febrile disturbance in connection with lactation in these days, in which the starving of puerperal patients is not considered necessary. It is certain that anything deserving the name of milk fever is now altogether exceptional, and such feverishness as exists is generally quite transient. It is also a fact that it is most apt to occur in delicate and weakly women, especially in those who do not, or are unable to, nurse. There does not, however, seem to be any sufficient reason for referring it, even when tolerably well marked, to septicæmia. The relief which attends the emptying of the breasts seems sufficient to prove its connection with lactation, and the discomfort which is necessarily associated with the swollen and turgid mammæ is of itself quite sufficient to explain it.

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[1] "Puerperal Temperatures," Obstet. Trans., vol. ix.

[2] Mon. f. Geburt, Dec. 1868.

Contraction of the Uterus after Delivery.—Immediately after delivery the uterus contracts firmly, and can be felt at the lower part of the abdomen as a hard, firm mass, about the size of a cricket-ball. After a time it again relaxes somewhat; and alternate relaxations and contractions go on, at intervals, for a considerable time after the expulsion of the placenta. The more complete and permanent the contraction, the greater the safety and comfort of the patient; for when the organ remains in a state of partial relaxation, coagula are apt to be retained in its cavity, while, for the same reason, air finds its way more readily into it. Hence decomposition is favored, and the chances of septic absorption much increased; while, even when this does not occur, the muscular fibres are excited to contract, and severe after-pains are produced.

After the first few days the diminution in the size of the uterus progresses with great rapidity. By about the sixth day it is so much lessened as to project not more than 1½ or 2 inches above the pelvic brim, while by the eleventh day it is no longer to be made out by abdominal palpation. Its increased size is, however, still quite apparent per vaginam, and, should occasion arise for making an internal examination, the mass of the lower segment of the uterus, with its flabby and patulous cervix, can be felt for some weeks after delivery. This may sometimes be of practical value in cases in which it is necessary to ascertain the fact of recent delivery, and under these circumstances, as pointed out by Simpson, the uterine sound would also enable us to prove that the cavity of the uterus is considerably elongated. Indeed, the normal condition of the uterus and cervix is not regained until six weeks or two months after labor. These observations are corroborated by investigations on the weight of the organ at different periods after labor. Thus, Heschl[1] has shown that the uterus, immediately after delivery, weighs about 22 to 24 oz.; within a week, it weighs 19 to 21 oz.; and at the end of the second week, 10 to 11 oz. only. At the end of the third week, it weighs 5 to 7 oz.; but it is not until the end of the second month that it reaches its normal weight. Hence it appears that the most rapid diminution occurs during the second week after delivery.

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[1] Researches on the Conduct of the Human Uterus after Delivery.

Fatty Transformation of the Muscular Fibres.—The mode in which this diminution in size is effected is by the transformation of the enormously hypertrophied muscular fibres into molecular fat, which is absorbed into the maternal vascular system, which, therefore, becomes loaded with a large amount of effete material. Heschl has shown that the entire mass of the enlarged uterine muscles is removed, and replaced by newly-formed fibres, which commence to be developed about the fourth week after delivery, the change being complete about the end of the second month. Generally speaking, the process of involution goes on without interruption. It is, however, apt to be interfered with by a variety of causes, such as premature exertion, intercurrent disease, and, very probably, by neglect of lactation. Hence the uterus often remains large, bulky, and sub-involuted, and the foundation for many subsequent uterine ailments is laid.

Changes in the Uterine Mucous Membrane.—The changes going on in the lining membrane of the uterus immediately after delivery are of immense importance in leading to a knowledge of the puerperal state, and have already been discussed when describing the decidua (p. 90). Its cavity is covered with a reddish-gray film, formed of blood and fibrine. The open mouths of the uterine sinuses are still visible, more especially over the site of the placenta, and thrombi may be seen projecting from them. The placental site can be very distinctly made out, in the form of an irregularly oval patch, where the lining membrane is thicker than elsewhere. The vagina soon contracts, and by the time the puerperal month is over it has returned to its normal dimensions, but after child-bearing it always remains more lax, and less rugous, than in nulliparæ. The vulva, at first very lax and much distended, soon regains its former state. The abdominal parietes remain loose and flabby for a considerable time, and the white streaks, produced by the distension of the cutis, very generally leave permanent marks. In some women, especially when proper support by bandaging has not been given, the abdomen remains permanently loose and pendulous.

The Lochial Discharge.—From the time of delivery, up to about three weeks afterwards, a discharge escapes from the interior of the uterus, known as the *lochia*. At first this consists almost entirely of pure blood, mixed with a variable amount of coagula. If efficient uterine contraction have not been secured after the expulsion of the placenta, coagula of considerable size are frequently expelled with the lochia for one or two days after delivery. In three or four days the distinctly bloody character of the lochia is altered. They have a reddish, watery appearance, and are known as the *lochia rubra* or *cruenta*. According to the researches of Wertheimer,[1] they are at this time composed chiefly of blood corpuscles, mixed with epithelium scales, mucus corpuscles, and the débris of the decidua. The change in the appearance of the discharge progresses gradually, and about the seventh or eighth day it has no longer a red color, but is a pale greenish fluid, with a peculiar sickening and disagreeable odor, and is familiarly described as the "green waters." It now contains a smaller quantity of blood corpuscles, which lessen in amount from day to day, but a considerable number of pus corpuscles, which remain the principal constituent of the discharge until it ceases. Besides these, epithelial scales, fatty granules, and crystals of cholesterine, are observed. Occasionally a small infusorium, which has been named the "trichomena vaginalis," has been detected; but it is not of constant occurrence.

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[1] Virchow's Archiv, 1861.

The amount of the lochia varies much, and in some women it is habitually more abundant than in others. Under ordinary circumstances it is very scanty after the first fortnight; but occasionally it continues somewhat abundant for a month or more, without any bad results. It is apt again to become of a red color, and to increase in quantity, in consequence of any slight excitement or disturbance. If this red discharge continue for any undue length of time, there is reason to suspect some abnormality, and it may not unfrequently be traced to slight lacerations about the cervix which have not healed properly. This result may also follow premature exertion, interfering with the proper involution of the uterus; and the patient should certainly not be allowed to move about as long as any amount of colored discharge is going on.

Occasionally the lochia have an intensely fetid odor. This symptom must always give rise to some anxiety, since it often indicates the retention and putrefaction of coagula, and involves the risk of septic absorption. It is not very rare, however, to observe a most disagreeable odor persist in the lochia without any bad results. The fœtor always deserves careful attention; and an endeavor should be made to obviate it by directing the nurse to syringe out the vagina freely night and morning with Condy's fluid and water; while, if it be associated with quickened pulse and elevated temperature, other measures, to be subsequently described, will be necessary.

The *after-pains*, which many child-bearing women dread even more than the labor-pains, are irregular contractions, occurring for a varying time after delivery, and resulting from the efforts of the uterus to expel coagula which have formed in its interior. If, therefore, special care be taken to secure complete and permanent contraction after labor, they rarely occur, or to a very slight extent. Their dependence on uterine inertia is evidenced by the common observation that they are seldom met with in primiparæ, in whom uterine contraction may be supposed to be more efficient, and are most frequent in women who have borne many children. They are a preventable complication, and one which need not in itself give rise to any anxiety; they are, indeed, rather salutary than the reverse, for if coagula be retained in utero, the sooner they are expelled the better. The after-pains generally begin a few hours after delivery, and continue, in bad cases, for three or four days, but seldom longer. When at their height, they are often relieved by the expulsion of the coagula. They may be readily distinguished from pains due to more serious causes, by feeling the enlarged uterus harden under their influence, by the uterus not being tender on pressure, and by the absence of any constitutional symptoms.

The *management of women after child-birth* has varied much at different times, according to fashion or theory. The dread of inflammation long influenced the professional mind, and caused the adoption of a strictly antiphlogistic diet, which led to a tardy convalescence. The recognition of the essentially physiological character of labor has resulted in more sound views, with manifest advantage to our patients. The main facts to bear in mind with regard to the puerperal woman are—her nervous susceptibility, which necessitates quiet and absence of all excitement; the importance of favoring involution by prolonged rest; and the risk of septicæmia, which calls for perfect cleanliness, and attention to hygienic precautions.

As soon as we are satisfied that the uterus is perfectly contracted, and that all risk of hemorrhage is over, the patient should be left to sleep. Many practitioners administer an opiate; but, as a matter of routine, this is certainly not good practice, since it checks the contractions of the uterus, and often produces unpleasant effects. Still, if the labor have been long and tedious, and the patient be much exhausted, 15 or 20 drops of Battley's solution may be administered with advantage.

Within a few hours the patient should be seen, and at this first visit particular attention should be paid to the states of the pulse, the uterus, and the bladder. The pulse during the whole period of convalescence should be carefully watched, and, if it be at all elevated, the temperature should at once be taken. If the pulse and temperature remain normal, we may be satisfied that things are going on well; but if the one be quickened and the other elevated, some disturbance or complication may be apprehended. The abdomen should be felt, to see that the uterus is not unduly distended, and that there is no tenderness. After the first day or two this is no longer necessary.

Treatment of Retention of Urine.—Sometimes the patient cannot at first void the urine, and the application of a hot sponge over the pubes may enable her to do so. If the retention of urine be due to temporary paralysis of the bladder, three or four- 20 minim doses of the liquid extract of ergot, at intervals of half an hour, may prove successful. Many hours should not be allowed to elapse without relieving the patient by the catheter, since prolonged retention of urine is only likely to make matters worse. Subsequently, it may be necessary to empty the bladder night and morning, until the patient regains her power over it, or until the swelling of the urethra subsides, which will generally be the case in a few days. Occasionally the bladder is largely distended, and is relieved to some degree by dribbling of urine from the urethra. Such a state of things may deceive the patient and nurse, and may produce very serious consequences by causing cystitis. Attention to the condition of the abdomen will prevent the practitioner from being deceived, for, in addition to some constitutional disturbance, a large, tender, and fluctuating swelling will be found in the hypogastric region, distinct from the uterus, which it displaces to one or other side. The catheter will at once prove that this is produced by distension of the bladder.

Treatment of Severe After-Pains.—If the after-pains be very severe, an opiate may be administered, or, if the lochia be not over-abundant, a linseed-meal poultice, sprinkled with laudanum, or with the chloroform and belladonna liniment, may be applied. If proper care have been taken to induce uterine contraction, they will seldom be sufficiently severe to require treatment. In America, quinine, in doses of 10 grains twice daily, has been strongly recommended, especially when opiates fail, and when the pains are neuralgic in character; and I have found this remedy answer extremely well.

Diet and Regimen.—The diet of the puerperal patient claims careful attention, the more so as old prejudices in this respect are as yet far from exploded, and as it is by no means rare to find mothers and nurses who still cling tenaciously to the idea that it is essential to prescribe a low regimen for many days after labor. The erroneousness of this plan is now so thoroughly recognized that it is hardly necessary to argue the point. There is, however, a tendency in some to error in the opposite direction, which leads them to insist on the patient's consuming solid food too soon after delivery, before she has regained her appetite, thereby producing nausea and intestinal derangement. Our best guide in this matter are the feelings of the patient herself. If, as is often the case, she be disinclined to eat, there is no reason why she should be urged to do so. A good cup of beef tea, some bread and milk, or an egg beaten up with milk, may generally be given with advantage shortly after delivery; and many patients are not inclined to take more for the first day or so. If the patient be hungry, there is no reason why she should not have some more solid, but easily digested, food, such as white fish, chicken, or sweetbread; and after a day or two she may resume her ordinary diet, bearing in mind that, being confined to bed, she cannot with advantage consume the same amount of solid food as when she is up and about. Dr. Oldham, in his presidential address to the Obstetrical Society,[1] has some apposite remarks on this point, which are worthy of quotation. "A puerperal month under the guidance of a monthly nurse is easily drawn out, and it is well if a love of the comforts of illness and the persuasion of being delicate, which are the infirmities of many women, do not induce a feeble life, which long survives after the occasion of it is forgotten. I know no reason why, if a woman is confined early in the morning, she should not have her breakfast of tea and toast at nine, her luncheon of some digestible meat at one, her cup of tea at five, her dinner with chicken at seven, and her tea again at nine, or the equivalent, according to the variation of her habits of living. Of course, there is the common-sense selection of articles of food, guarding against excess, and avoiding stimulants. But gruel and slops, and all intermediate feeding, are to be avoided." No one who has seen both methods adopted can fail to have been struck with the more rapid and satisfactory convalescence which takes place when the patient's strength is not weakened by an unnecessarily low diet. Stimulants, as a rule, are not required; but if the patient be weakly and exhausted, or if she be accustomed to their use, there can be no reasonable objection to their judicious administration.

Attention to Cleanliness, &c.—Immediately after delivery a warm napkin is applied to the vulva, and, after the patient has rested a little, the nurse removes the soiled linen from the bed, and washes the external genitals. It is impossible to pay too much attention during the subsequent progress of the case to the maintenance of perfect cleanliness. The linen should be frequently changed, and all dirty linen and discharges immediately removed from the apartment. The vulva should be washed daily with Condy's fluid and water, and the patient will derive great comfort from having the vagina syringed gently out once a day with the same solution. The room should be kept tolerably cool, and fresh air freely admitted.

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[1] Obstet. Trans., vol. vi.

Action of the Bowels.—It is customary, on the morning of the second or third day, to secure an action of the bowels; and there is no better way of doing this than by a large enema of soap and water. If the patient object to this, and the bowels have not acted, some mild aperient may be administered, such as a small dose of castor-oil, a few grains of colocynth and henbane pill, or the popular French aperient, the "Tamar Indien."

Lactation.—The management of suckling and of the breasts forms an important part of the duties of the monthly nurse, which the practitioner should himself superintend. This will be more conveniently discussed under the head of lactation.

Prolonged Rest.—The most important part of the management of the puerperal state is the securing to the patient prolonged rest in the horizontal position, in order to favor proper involution of the uterus. For the first few days she should be kept as quiet and still as possible, not receiving the visits of any but her nearest relatives, thus avoiding all chances of undue excitement. It is customary among the better classes for the patient to remain in bed for eight or ten days; but, provided she be doing well, there can be no objection to her lying on the outside of the bed, or slipping on to a sofa, somewhat sooner. After ten days or a fortnight, she may be permitted to sit on a chair for a little; but I am convinced that the longer she can be persuaded to retain the recumbent position, the more complete and satisfactory will be the progress of involution; and she should not be allowed to walk about until the third week, about which time she may also be permitted to take a drive. If it be borne in mind that it takes from six weeks to two months for the uterus to regain its natural size, the reason for prolonged rest will be obvious. The judicious practitioner, however, while insisting on this point, will take measures, at the same time, not to allow the patient to lapse into the habits of an invalid, or to give the necessary rest the semblance of disease.

Subsequent Treatment.—Towards the termination of the puerperal month, some slight tonic, such as small doses of quinine with phosphoric acid, may often be given with advantage, especially if convalescence be tardy. Nothing is so beneficial in restoring the patient to her usual health as change of air; and in the upper classes a short visit to the seaside may generally be recommended, with the certainty of much benefit.

CHAPTER II.

MANAGEMENT OF THE INFANT, LACTATION, ETC.

ALMOST immediately after its expulsion a healthy child cries aloud, thereby showing that respiration is established; and this may be taken as a signal of its safety. The first respiratory movements are excited, partly by reflex action resulting from the contact of cold external air on the cutaneous nerves, and partly by the direct irritation of the medulla oblongata, in consequence of the circulation through it of blood no longer oxygenated in the placenta.

Apparent Death of the New-born Child.—Not unfrequently the child is born in an apparently lifeless state. This is especially apt to be the case when the second stage of labor has been unduly prolonged, so that the head has been subjected to long-continued pressure. The utero-placental circulation is also apt to be injuriously interfered with before the birth of the child when a tardy labor has produced tonic contraction of the uterine fibres, and consequent closure of the uterine sinuses; or, more rarely, from such causes as the injudicious administration of ergot, premature separation of the placenta, or compression of the umbilical cord. In any of these cases it is probable that the arrest of the utero-placental circulation induces attempts at inspiration, which, however, are necessarily fruitless, since air cannot reach the lungs, and the fœtus may die asphyxiated; the existence of the respiratory movement being proved on post-mortem examination by the presence in the lungs of liquor amnii, mucus, and meconium, and by the extravasation of blood from the rupture of their engorged vessels.

Appearance of the Child.—In most cases when the child is born in a state of apparent asphyxia, its face is swollen and of a dark livid color. It not unfrequently makes one or two feeble and gasping efforts at respiration, without any definite cry; on auscultation the heart may be heard to beat weakly and slowly. Under such circumstances there is a fair hope of its recovery. In other cases the child, instead of being turgid and livid in the face, is pale, with flaccid limbs, and no appreciable cardiac action—when the prognosis is much more unfavorable.

Treatment of Apparent Death.—No time should be lost in endeavoring to excite respiration, and at first this must be done by applying suitable stimulants to the cutaneous nerves, in the hope of exciting reflex action. The cord should be at once tied, so that the child may be removed from the mother; for the final uterine contractions have so completely arrested the utero-placental circulation as to render it no longer of any value. If the face be very livid, a few drops of blood may with advantage be allowed to flow from the cord before it is tied, with the view of relieving the embarrassed circulation. Very often some slight stimulus, such as one or two sharp slaps on the thorax, or rapidly rubbing the body with brandy poured into the palms of the hands, will suffice to induce respiration. Failing this, nothing acts so well as the sudden and instantaneous application of heat and cold. For this purpose extremely hot water is placed in one basin, and quite cold water in another. Taking the child by the shoulders and legs, it should be dipped for a single moment into the hot water, and then into the cold; and these alternate applications may be repeated once or twice, as occasion requires. The effect of this measure is often very marked, and I have frequently seen it succeed when prolonged efforts at artificial respiration had been made in vain. If these means fail, an endeavor must be at once made to carry on respiration artificially; and we have various methods to choose from, the ones most generally used in this country being those of Marshall Hall and Sylvester. The Sylvester method is, on the whole, that which is most easily applied, and, on account of the compressibility of the thorax, it is peculiarly suitable for infants. The child being laid on its back, with the shoulders slightly elevated, the elbows are grasped by the operator, and alternately raised above the head and then slowly depressed against the sides of the thorax, so as to produce the effect of inspiration and expiration. If this do not succeed, the Marshall Hall method may be substituted; and one or more of the plans of exciting reflex action through the cutaneous nerves may be alternated with it. Other means of exciting respiration have been recommended. One of them, much used abroad, is the artificial insufflation of the lungs by means of a flexible catheter guided into the glottis. It is not difficult to pass the end of a catheter into the glottis, using the little finger as a guide; and, once in position, it may be used to blow air gently into the lungs, which is expelled by compression on the thorax, the insufflation being repeated at short intervals of about ten seconds. One advantage of this plan is that it allows the liquor amnii and other fluids, which may have been drawn into the lungs in the premature efforts at respiration before birth, to be sucked up into the catheter, and so removed from the lungs. The same effect may be produced, but less perfectly, by placing the hand over the nostrils of the child, blowing into its mouth, and immediately afterwards compressing the thorax. One of these methods should certainly be tried, if all other means have failed. Faradization along the course of the phrenic nerves is a promising means of inducing respiration, which should be used if the proper apparatus can be procured. Encouragement to persevere in our endeavors to resuscitate the child may be derived from the numerous authenticated instances of success after the lapse of a considerable time, even of an hour or more. As long as the cardiac pulsations continue, however feebly, there is no reason to despair.

Washing and Dressing of the Child.—When the child cries lustily from the first, it is customary for the nurse to wash and dress it as soon as her immediate attendance on the mother is no longer required. For this purpose it is placed in a bath of warm water, and carefully soaped and sponged from head to foot. With the view of facilitating the removal of the unctuous material with which it is covered, it is usual to anoint it with cold cream or olive-oil, which is washed off in the bath. Nurses are apt to use undue roughness in endeavoring to remove every particle of the vernix caseosa, small portions of which are often firmly adherent. This mistake should be avoided, as these particles will soon dry up and become spontaneously detached. The cord is generally wrapped in a small piece of charred linen, which is supposed to have some slight antiseptic property, and this is renewed from day to day until the cord has withered and separated; and this generally occurs within a week. Then a small pad of soft linen is placed over the umbilicus, and supported by a flannel belly-band, placed round the abdomen, which should not be too tight, for fear of embarrassing the respiration. By this means the tendency to umbilical hernia is prevented.

The *clothing* of the infant varies according to fashion and the circumstances of the parents. The important points to bear in mind are that it should be warm (since newly-born children are extremely susceptible to cold), and at the same time light, and sufficiently loose to allow free play to the limbs and thorax. All tight bandaging and swaddling, such as is common in some parts of the Continent, should be avoided, and the clothes should be fastened by strings or by sewing, and no pins used. At the present day it is customary not to use caps, so that the head may be kept cool. The utmost possible attention should be paid to cleanliness, and the child should be regularly bathed in tepid water, at first once daily, and, after the first few weeks, both night and morning. After drying, the flexures of the thighs and arms, and the nates, should be dusted with violet powder or fuller's earth, to prevent chafing of the skin. The excrements should be received in napkins wrapped round the hips, and great care is required to change the napkins as often as they are wet or soiled; otherwise troublesome irritation will arise. A neglect of this precaution, and the washing of the napkins with coarse soap or soda, are among the principal causes of the eruptions and excoriations so common in badly-cared-for children. When washed and dressed, the child may be placed in its cradle, and covered with soft blankets or an eider-down quilt.

Application of the Child to the Breast.—As soon as the mother has rested a little, it is advisable to place the child to the breast. This is useful to the mother by favoring uterine contraction. Even now there is in the breasts a variable quantity of the peculiar fluid known as *colostrum.* This is a viscid yellowish secretion, different in appearance from the thin bluish milk which is subsequently formed. Examined under the microscope it is found to contain some milk globules, a number of large granular corpuscles, and small fat corpuscles. It has a purgative property, and soon produces a discharge of the meconium with which the bowels are loaded, and with less irritation than any of the laxatives so generally used. Hence the accoucheur should prohibit the common practice of administering castor-oil, or other aperient, within the first few days after birth: although there can be no objection to it, in special cases, if the bowels appear to act inefficiently and with difficulty.

For the first few days, and until the secretion of milk is thoroughly established, the child should be put to the breast at long intervals only. Constant attempts at suckling an empty breast lead to nothing but disappointment, both to the mother and child, and, by unduly irritating the mammæ, sometimes to positive harm. Therefore, for the first day or two it is sufficient if the child be applied to the breast twice, or at most three times, in the twenty-four hours. Nor is it necessary to be apprehensive, as many mothers naturally are, that the child will suffer from want of food. A few spoonfuls of milk-and-water may be given from time to time, but the child may generally wait without injury until the milk is secreted. This is generally about the third day, when the secretion is found to be a whitish fluid, more watery in appearance than cow's milk, and showing under the microscope an abundance of minute spherical globules, refracting light strongly, which are abundant in proportion to the quality of the milk. A certain number of granular corpuscles may also be observed shortly after the birth of the child, but after the first month these should have almost altogether disappeared. The reaction of human milk is decidedly alkaline, and the taste much sweeter than that of cow's milk.

The importance to the mother of nursing her own child, whenever her health permits, on account of the favorable influence of lactation in promoting a proper involution of the uterus, has already been insisted on. Unless there be some positive contra-indication, such as a marked strumous cachexia, or great general debility, it is the duty of the accoucheur to urge the mother to attempt lactation, even if it be not carried on more than a month or two. It is, however, the fact that in the upper classes of society a large number of patients are unable to nurse, even though willing and anxious to do so. In some there is hardly any lacteal secretion at all; in others there is at first an over-abundance of watery and innutritious milk, which floods the breasts, and soon dies away altogether.

Whenever the mother cannot or will not nurse, the question will arise as to the method of bringing up the child. From many causes there is an increasing tendency to resort to bottle-feeding, instead of procuring the services of a wet-nurse, even when the question of expense does not come into consideration. No long experience is required to prove that hand-feeding is a bad and imperfect substitute for nature's mode, and one which the practitioner should discourage whenever it lies in his power to do so. It is true that, in a large proportion of cases, bottle-fed children do well; but there is good reason to believe that, even when apparently most successful, the children are not so strong in after-life as they would have been had they been brought up at the breast. When, in addition, it is borne in mind how much of the success of hand-feeding depends on intelligent care on the part of the nurse, what evils are apt to accrue from injurious selection of food and from ignorance of the commonest laws of dietetics, there is abundant reason for urging the substitution of a wet-nurse whenever the mother is unable to undertake the suckling of her child. It must be admitted that good hand-feeding is better than bad wet-nursing; and the success of the latter hinges on the proper selection of a wet-nurse. As this falls within the duties of the practitioner, it will be well to point out the qualities which should be sought for in a wet-nurse, before proceeding to discuss the mode of rearing the child at the breast.

Selection of a Wet-Nurse.—In selecting a wet-nurse, we should endeavor to choose a strong, healthy woman, who should not be over 30, or 35 years of age at the outside, since the quality of the milk deteriorates in women who are more advanced in life. For a similar reason a very young woman, of 16 or 17, should be rejected. It is needless to say that care must be taken to ascertain the absence of all traces of constitutional disease, especially marks of scrofula, or enlarged cervical or inguinal glands, which may possibly be due to antecedent syphilitic taint. If the nurse be of good muscular development, healthy-looking, with a clear complexion, and sound teeth (indicating a generally good state of health), the color of the hair and eyes is of secondary importance. It is commonly stated that brunettes make better nurses than blondes; but this is by no means necessarily the case; and, provided all the other points be favorable, fairness of skin and hair need be no bar to the selection of a nurse. The breasts should be pear-shaped, rather firm, as indicating an abundance of gland tissue, and with the superficial veins well marked. Large, flabby breasts owe much of their size to an undue deposit of fat, and are generally unfavorable. The nipple should be prominent, not too large, and free from cracks and erosions, which, if existing, might lead to subsequent difficulties in nursing. On pressing the breast the milk should flow from it easily in a number of small jets, and some of it should be preserved for examination. It should be of a bluish-white color, and of a somewhat watery appearance, and, when placed under the microscope, the field should be covered with an abundance of milk corpuscles, and the large granular corpuscles of the colostrum should have entirely disappeared. If the latter be observed in any quantity in a woman who has been confined five or six weeks, the inference is that the milk is inferior in quality. It is not often that the practitioner has an opportunity of inquiring into the moral qualities of the nurse; although much valuable information might be derived from a knowledge of her previous character. An irascible, excitable, or highly nervous woman will certainly make a bad nurse, and the most trivial causes might afterwards interfere with the quality of her milk. Particular attention should be paid to the nurse's own child, since its condition affords the best criterion of the quality of her milk. It should be plump, well nourished, and free from all blemishes. If it be at all thin and wizened, especially if there be any snuffling at the nose, the nurse should be unhesitatingly rejected.

The *management of lactation* is much the same whether the child is nursed by the mother or by a wet-nurse. As soon as the supply of milk is sufficiently established, the child must be put to the breast at short intervals, at first of about two hours, and, in about a month or six weeks, of three hours. From the first few days it is a matter of the greatest importance, both to the mother and child, to acquire regular habits in this respect. If, as is unfortunately so often the case, the mother get into the way of allowing the infant to take the breast whenever it cries, as a means of keeping it quiet, her own health must soon suffer, to say nothing of the discomfort of being incessantly tied to the child's side; while the child itself has not sufficient rest to digest its food, and, very shortly, diarrhœa or other symptoms of dyspepsia are pretty sure to follow. After a month or two the infant should be trained to require the breast less often at night, so as to enable the mother to have an undisturbed sleep of six or seven hours. For this purpose she should arrange the times of nursing so as to give the breast just before she goes to bed, and not again until the early morning. If the child should require food in the interval, a little milk-and-water, in the bottle, may be advantageously given.

The *diet of the nursing woman* should be arranged on ordinary principles of hygiene. It should be abundant, simple, and nutritious, and all rich and stimulating articles of food should be avoided. A common error in the diet of wet-nurses is over-feeding, which constantly leads to deterioration of the milk. Many of these women, before entering on their functions, have been living on the simplest and even sparest diet, and not uncommonly, in the better class of houses, they are suddenly given heavy meat meals three and even four times a day, and often three or four glasses of stout. It is hardly a matter of astonishment that, under such circumstances, their milk should be found to disagree. For a nursing woman in good health, two good meat meals a day, with two glasses of beer or porter, and as much milk and bread-and-butter as she likes to take in the interval, should be amply sufficient.

Signs of Successful Lactation.—Plenty of moderate exercise should be taken, and the more nurse and child are out in the open air, provided the weather be reasonably fine, the better it is for both. Carried on methodically in this manner, wet-nursing should give but little trouble. In the intervals between its meals the child sleeps most of its time, and wakes with regularity to feed; and if the contrary be the case, if the child be wakeful and restless, cry after feeding, have disordered bowels, and, above all, if it do not gain, week by week, in weight (a point which should be, from time to time, ascertained by the scales), we may conclude that there is either some grave defect in the management of lactation, or that the milk is not agreeing with the child. Should this unsatisfactory progress continue, in spite of our endeavors to remedy it, there is no resource left but the alteration of the diet, either by changing the nurse or by bringing up the child by hand. The former should be preferred whenever it is practicable, and in the upper ranks of life it is by no means rare to have to change the wet-nurse two or three times before one is met with whose milk agrees perfectly with the child. If the child have reached six or seven months of age, it may be preferable to wean it altogether, especially if the mother have nursed it, as hand-feeding is much less objectionable if the infant have had the breast for even a few months.

Period of Weaning.—As a rule, weaning should not be attempted until dentition is fairly established, that being the sign that nature has prepared the child for an alteration of food; and it is better that the main portion of the diet should be breast-milk until at least six or seven teeth have appeared. This is a safer guide than any arbitrary rule taken from the age of the child, since the commencement of dentition varies much in different cases. About the sixth or seventh month it is a good plan to commence the use of some suitable artificial food once a day, so as to relieve the strain on the mother or nurse, and prepare the child for weaning, which should always be a very gradual process. In this way a meal of rusks, of the entire wheat flour, or of beef- or chicken-tea, with bread-crumb in it, may be given with advantage; and, as the period for weaning arrives, a second meal may be added, and so eventually the child may be weaned without distress to itself or trouble to the nurse.

The *disorders of lactation* are numerous, and, as they frequently come under the notice of the practitioner, it is necessary to allude to some of the most common and important.

Means of arresting the Secretion of Milk.—The advice of the accoucheur is often required in cases in which it has been determined that the patient is not to nurse, when we desire to get rid of the milk as soon as possible, or when, at the time of weaning, the same object is sought. The extreme heat and distension of the breasts, in the former class of cases, often give rise to much distress. A smart saline aperient will aid in removing the milk, and for this purpose a double Seidlitz powder, or frequent small doses of sulphate of magnesia, act well; while, at the same time, the patient should be advised to take as small a quantity of fluid as possible. Iodide of potassium in large doses, of 20 or 25 grains, repeated twice or thrice, has a remarkable effect in arresting the secretion of milk. This observation was first empirically made by observing that the secretion of milk was arrested when this drug was administered for some other cause, and I have frequently found it answer remarkably well. The distension of the breasts is best relieved by covering them with a layer of lint or cotton wool, soaked in a spirit lotion, or eau de cologne and water, over which oiled silk is placed, and by directing the nurse to rub them gently with warm oil whenever they get hard and lumpy. Breast-pumps and similar contrivances only irritate the breasts, and do more harm than good. The local application of belladonna has been strongly recommended as a means for preventing lacteal secretion. As usually applied, in the form of belladonna plaster, it is likely to do more harm than good, since the breast often enlarges after the plasters are applied, and the pressure of the unyielding leather on which they are spread produces intense suffering. A better way of using it is by rubbing down a drachm of the extract of belladonna with an ounce of glycerine, and applying this on lint. In some cases it answers extremely well; but it is very uncertain in its action, and frequently is quite useless.

Defective Secretion of Milk.—A deficiency of milk in nursing mothers is a very common cause of difficulty. In a wet-nurse this drawback is, of course, an indication for changing the nurse; but to the mother the importance of nursing is so great that an endeavor must be made either to increase the flow of milk or to supplement it by other food. Unfortunately, little reliance can be placed on any of the so-called galactagogues. The only one which in recent times has attracted attention is the leaves of the castor-oil plant, which, made into poultices and applied to the breast, are said to have a beneficial effect in increasing the flow of milk. More reliance must be placed in a sufficiency of nutritious food, especially such as contains phosphatic elements; stewed eels, oysters and other kinds of shell-fish, and the Revalenta Arabica, are recommended by Dr. Routh, who has paid some attention to this point,[1] as peculiarly appropriate. If the amount of milk be decidedly deficient, the child should be less often applied to the breast, so as to allow milk to collect, and properly prepared cow's milk from a bottle should be given alternately with the breast. This mixed diet generally answers well, and is far preferable to pure hand-feeding.

Depressed Nipples.—A not uncommon source of difficulty is a depressed condition of the nipples, which is generally produced by the constant pressure of the stays. The result is that the child, unable to grasp the nipple, and wearied with ineffectual efforts, may at last refuse the breast altogether. An endeavor should be made to elongate the nipple before putting it into the child's mouth, either by the fingers, or by some form of breast-pump, which here finds a useful indication. In the worst class of cases, when the nipple is permanently depressed, it may be necessary to let the child suck through a glass nipple-shield, to which is attached an india-rubber tube, similar to that of a sucking-bottle; this it is generally well able to do.

Fissures and excoriations of the nipples are common causes of suffering, in some cases leading to the formation of mammary abscess. Whenever the practitioner has the opportunity, he should advise his patient to prepare the nipple for nursing in the latter months of pregnancy, and this may best be done by daily bathing it with a spirituous or astringent lotion, such as eau de cologne and water, or a weak solution of tannin. After nursing has begun, great care should be taken to wash and dry the nipple after the child has been applied to it, and, as long as the mother is in the recumbent position, she may, if the nipples be at all tender, use zinc nipple-shields with advantage, when she is not nursing. In this way these troublesome complications may generally be prevented. The most common forms are either an abrasion on the surface of the nipple, which if neglected may form a small ulcer, or a crack at some part of the nipple, most generally at its base. In either case the suffering when the child is put to the breast is intense, sometimes indeed amounting to intolerable anguish, causing the mother to look forward with dread to the application of the child; and, whenever such pain is complained of, the nipple should be carefully examined, since the fissure or sore is often so minute as to escape superficial examination. The remedies recommended are very numerous, and not always successful. Amongst those most commonly used are astringent applications, such as tannin, or weak solutions of nitrate of silver, or cauterizing the edges of the fissure with the solid nitrate of silver, or applying the flexible collodion of the Pharmacopœia. Dr. Wilson, of Glasgow, speaks highly of a lotion composed of ten grains of nitrate of lead in an ounce of glycerine, which is to be applied after sucking, the nipple being carefully washed before the child is put to the breast. I have myself found nothing answer so well as a lotion composed of half an ounce of sulphurous acid, half an ounce of the glycerine of tannin, and an ounce of water, the beneficial effects of which are sometimes quite remarkable. Relief may occasionally be obtained by inducing the child to suck through a nipple-shield, especially when there is only an excoriation; but this will not always answer, on account of the extreme pain which it produces.

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[1] Routh on Infant Feeding.

An *excessive flow of milk*, known as *galactorrhœa*, often interferes with successful lactation. It is by no means rare in the first weeks after delivery in women of delicate constitution, who are really unfit to nurse, and who are flooded with a superabundance of watery and innutritious milk, which soon produces disordered digestion in the child. Under such circumstances, the only thing to be done is to give up an attempt which is injurious both to the mother and child. At a later stage the milk, secreted in large quantities, is sufficiently nourishing to the child, but the drain on the mother's constitution soon begins to tell on her. Palpitation, giddiness, emaciation, headache, loss of sleep, spots before the eyes, and even amaurosis, indicate the serious effects which are being produced, and the absolute necessity of at once stopping lactation. Whenever, therefore, a nursing woman suffers from such symptoms, it is far better at once to remove the cause; otherwise a very serious and permanent deterioration of health might result.

Mammary Abscess.—There is no more troublesome complication of lactation than the formation of abscess in the breast; an occurrence by no means rare, and which, if improperly treated, may, by long-continued suppuration and the formation of numerous sinuses in and about the breast, produce very serious effects on the general health. The causes of breast abscess are numerous, and very trivial circumstances may occasionally set up inflammation, ending in suppuration. Thus, it may follow exposure to cold; a blow or other injury to the breast; some temporary engorgement of the lacteal tubes; or even sudden or depressing mental emotions. The most frequent cause is irritation from fissures or erosions of the nipples, which must, therefore, always be regarded with suspicion, and cured as soon as possible.

Signs and Symptoms.—The abscess may form in any part of the breast, or in the areolar tissue below it; in the latter case the inflammation very generally extends to the gland structure. Abscess is usually ushered in by constitutional symptoms, varying in severity with the amount and situation of the inflammation. Pyrexia is always present; elevated temperature, rapid pulse, and much malaise and sense of feverishness, followed, in many cases, by distinct rigor, when deep-seated suppuration is taking place. On examining the breast it will be found to be generally enlarged and very tender, while at the site of the abscess an indurated and painful swelling may be felt. If the inflammation be chiefly limited to the sub-glandular areolar tissue, there may be no localized swelling felt, but the whole breast will be acutely sensitive, and the slightest movement will cause much pain. As the case progresses, the abscess becomes more and more superficial, the skin covering it is red and glazed, and, if left to itself, it bursts. In the more serious cases it is by no means rare for multiple abscesses to form. These, opening one after the other, lead to the formation of numerous fistulous tracts, by which the breast may become completely riddled. Sloughing of portions of the gland tissue may take place, and even considerable hemorrhage, from the destruction of blood-vessels. The general health soon suffers to a marked degree, and, as the sinuses continue to suppurate for many successive months, it is by no means uncommon for the patient to be reduced to a state of profound and even dangerous debility.

Treatment.—Much may be done by proper care to prevent the formation of abscess, especially by removing engorgement of the lacteal ducts, when threatened, by gentle hand-friction in the manner already indicated. When the general symptoms, and the local tenderness, indicate that inflammation has commenced, we should at once endeavor to moderate it, in the hope that resolution may occur without the formation of pus. Here general principles must be attended to, especially giving the affected part as much rest as possible. Feverishness may be combated by gentle salines, minute doses of aconite, and large doses of quinine; while pain should be relieved by opiates. The patient should be strictly confined to bed, and the affected breast supported by a suspensory bandage. Warmth and moisture are the best means of relieving the local pain, either in the form of hot fomentations, or of light poultices of linseed-meal or bread and milk, and the breast may be smeared with extract of belladonna rubbed down with glycerine, or the belladonna liniment sprinkled over the surface of the poultices. Generally the pain and irritation produced by putting the child to the breast are so great as to contra-indicate nursing from the affected side altogether, and we must trust to relieving the tension by poultices; lactation being, in the mean time, carried on by the other breast alone. In favorable cases this is quite possible for a time, and it may be that, if the inflammation do not end in suppuration, or if the abscess be small and localized, the affected breast is again able to resume its functions. Often this is not possible; and it may be advisable, in severe cases, to give up nursing altogether.

The subsequent management of the case consists in the opening of the abscess as soon as the existence of pus is ascertained, either by fluctuation, or, if the site of the abscess be deep-seated, by the exploring needle. In the latter case rigors will confirm the suspicion of suppuration having occurred. It may be laid down as a principle, that the sooner the pus is evacuated the better, and nothing is to be gained by waiting until it is superficial. On the contrary, such delay only leads to more extensive disorganization of tissue and the further spread of inflammation.

The method of opening the abscess is of primary importance. It has always been customary simply to open the abscess at its most depending part, without using any precaution against the admission of air, and afterwards to treat secondary abscesses in the same way. The results are well known to all practical accoucheurs, and the records of surgery fully show how many weeks or months generally elapse in bad cases before recovery is complete. The antiseptic treatment of mammary abscess, in the way first pointed out by Lister, affords results which are of the most remarkable and satisfactory kind. Instead of being weeks and months in healing, I believe that the practitioner who fairly and minutely carries out Mr. Lister's directions may confidently look for complete healing of the abscess in a few days; and I know nothing in the whole range of my professional experience that has given me more satisfaction than the application of this method to abscesses of the breast. The plan I have used is that first recommended by Lister in the "Lancet" for 1867, but which he has since greatly altered and improved. It is, however, easily within the reach of every one, and is so simple that no special skill or practice is required in its application; whereas the more perfected antiseptic appliances will probably not be so readily obtained, and are much more difficult to use. The method there described I have since adopted, without a single failure, in every case of breast abscess I have met with. In order that the full advantages of the antiseptic plan may be experienced, it is necessary that it should be carried out with minute attention to details, and therefore, at the risk of making a somewhat lengthy quotation, I copy Lister's own original directions:—"A solution of one part of crystallized carbolic acid in four parts of boiled linseed-oil having been prepared, a piece of rag from four to six inches square is dipped into the oily mixture, and laid upon the skin where the incision is to be made. The lower edge of the rag being then raised, while the upper edge is kept from slipping by an assistant, a common scalpel or bistoury dipped in the oil is plunged into the cavity of the abscess, and an opening about three-quarters of an inch in length is made, and the instant the knife is withdrawn the rag is dropped upon the skin as an antiseptic curtain, beneath which the pus flows out into a vessel placed to receive it. The cavity of the abscess is firmly pressed, so as to force out all existing pus as nearly as may be (the old fear of doing mischief by rough treatment of the pyogenic membrane being quite ill founded); and if there be much oozing of blood, or if there be considerable thickness of parts between the abscess and the surface, a piece of lint dipped in the antiseptic oil is introduced into the incision, to check bleeding and prevent primary adhesion, which is otherwise very apt to occur. The introduction of the lint is effected as rapidly as may be, and under the protection of the antiseptic rag. Thus the evacuation of the original contents is accomplished with perfect security against the introduction of living germs. This, however, would be of no avail unless an antiseptic dressing could be applied that would effectually prevent the decomposition of the stream of pus constantly flowing out beneath it. After numerous disappointments, I have succeeded with the following, which may be relied upon as absolutely trustworthy. About six teaspoonfuls of the above-mentioned solution of carbolic acid in linseed-oil are mixed up with common whiting (carbonate of lime) to the consistence of a firm paste, which is, in fact, glazier's putty with the addition of a little carbolic acid. This is spread upon a piece of common tin-foil about six inches square, so as to form a layer about a quarter of an inch thick. The tin-foil, thus spread with putty, is placed upon the skin, so that the middle of it corresponds to the position of the incision, the antiseptic rag used in opening the abscess being removed the instant before. The tin is then fixed securely by adhesive plaster, the lowest edge being left free for the escape of the discharge into a folded towel placed over it and secured by a bandage. The dressing is changed, as a general rule, once in twenty-four hours, but, if the abscess be a very large one, it is prudent to see the patient twelve hours after it has been opened, when, if the towel should be much stained with discharge, the dressing should be changed, to avoid subjecting its antiseptic virtues to too severe a test. But after the first twenty-four hours a single daily dressing is sufficient. The changing of the dressing must be methodically done, as follows. A second similar piece of tin-foil having been spread with the putty, a piece of rag is dipped in the oily solution and placed on the incision the moment the first tin is removed. This guards against the possibility of mischief occurring during the cleansing of the skin with a dry cloth and pressing out any discharge which may exist in the cavity. If a plug of lint was introduced when the abscess was opened, it is removed under cover of the antiseptic rag, which is taken off at the moment when the new tin is to be applied. The same process is continued daily until the sinus closes."

If the antiseptic plan be not used, or if the case come under our care when the abscess has been long discharging, or when sinuses have formed, the treatment is directed mainly to procuring a cessation of suppuration and closure of the sinuses. For this purpose methodical strapping of the breast with adhesive plaster, so as to afford steady support and compress the opposing pyogenic surfaces, will give the best results. It may be necessary to lay open some of the sinuses, or to inject tinct. iodi. or other stimulating lotions, so as to moderate the discharge, the subsequent surgical treatment varying according to the requirements of each individual case. As the drain on the system is great, and the constitutional debility generally pronounced, much attention must be paid to general treatment; and abundance of nourishing diet, appropriate stimulants, and such medicines as iron and quinine, will be indicated.

Hand-Feeding.—In a considerable number of cases the inability of the mother to nurse the child, her invincible repugnance to a wet-nurse, or inability to bear the expense, renders hand-feeding essential. It is, therefore, of importance that the accoucheur should be thoroughly familiar with the best method of bringing up the child by hand, so as to be able to direct the process in the way that is most likely to be successful.

Much of the mortality following hand-feeding may be traced to the administration of unsuitable articles of food. Among the poorer classes especially there is a prevalent notion that milk alone is insufficient; and hence the almost universal custom of administering various farinaceous foods, such as corn-flour or arrowroot, even from the earliest period. Many of these consist of starch alone, and are therefore absolutely unsuited for forming the staple of diet, on account of the total absence of nitrogenous elements. Independently of this, it has been shown that the saliva of infants has not the same digestive property on starch that it subsequently acquires, which affords a further explanation of its so constantly producing intestinal derangement. Reason, as well as experience, abundantly proves that the object to be aimed at in hand-feeding is to imitate as nearly as possible the food which nature supplies for the new-born child, and therefore the obvious course is to use milk from some animal, so treated as to make it resemble human milk as nearly as may be.

Ass's Milk.—Of the various milks used, that of the ass, on the whole, most closely resembles human milk, containing less casein and butter, and more saline ingredients. It is not always easy to obtain, and in towns is excessively expensive. Moreover, it certainly does not always agree with the child, and is apt to produce diarrhœa. We can, however, be more certain of its being unadulterated, which in large cities is in itself no small advantage, and it may be given without the addition of water or sugar.

Goat's milk in this country is still more difficult to obtain, but it often succeeds admirably. In many places the infant sucks the teat directly, and certainly thrives well on the plan.

Cow's Milk and its Preparation.—In a large majority of cases we have to rely on cow's milk alone. It differs from human milk in containing less water, a larger amount of casein and solid matters, and less sugar. Therefore, in order to prepare it for administration, it requires to be diluted and sweetened. A common mistake is over-dilution, and it is far from rare for nurses to administer one-third cow's milk to two-thirds water. The result of this excessive dilution is that the child becomes pale and puny, and has none of the firm and plump appearance of a well-fed infant. The practitioner should, therefore, ascertain that this mistake is not being made; and the necessary dilution will be best obtained by administering two-thirds pure fresh cow's milk, to which one-third hot water has been added, so as to warm the mixture to about 96°, the whole being slightly sweetened with sugar of milk, or ordinary crystallized sugar. After the first two or three months the amount of water may be lessened, and pure milk, warmed and sweetened, given instead. Whenever it is possible, the milk should be obtained from the same cow, and in towns some care is requisite to see that the animal is properly fed and stabled. Of late years it has been customary to obviate the difficulties of obtaining good fresh milk by using some of the tinned milks now so easily to be had. These are already sweetened, and sometimes answer well, if not given in too weak a dilution. One great fault in bottle-feeding is the tendency of the milk to become acid, and hence to produce diarrhœa. This may to a great extent be obviated by adding a tablespoonful of lime-water to each bottle, instead of an equal quantity of water.

Much of the success of bottle-feeding must depend on minute care and scrupulous cleanliness, points which cannot be too strongly insisted on. Particular attention should be paid to preparing the food fresh for every meal, and to keeping the feeding-bottle and tubes constantly in water when not in use, so that minute particles of milk may not remain about them and become sour. A neglect of this is one of the most fertile sources of the thrush from which bottle-fed infants often suffer. Subject to these precautions, the particular form of bottle used is not of much consequence. Those now commonly employed, with a long india-rubber tube attached, are preferable to the older forms of flat bottle, as requiring more effort at suction on the part of the infant, and thus forcing it to swallow the food more slowly. Care must be taken to give the meals at stated intervals, as in breast-feeding, and these should be at first about two hours apart, the period being gradually extended. The nurse should be strictly cautioned against the common practice of placing the bottle beside the infant in its cradle and allowing it to suck to repletion, a practice which certainly leads to over-distension of the stomach, and consequent dyspepsia. The child should be raised in the arms at the proper time, have its food administered, and then be replaced in the cradle to sleep. In the first few weeks of bottle-feeding, constipation is very common, and this may be easily and effectually remedied by placing as much phosphate of soda as will lie on a threepenny-piece in the bottle, two or three times in the twenty-four hours.

If this system succeed, no other food should be given until the child is six or seven months old, and then some of the various infant's foods may be cautiously commenced. Of these there are an immense number in common use; some of which are good articles of diet, others are physiologically unfitted for infants. In selecting these foods we have to see that they contain the essential elements of nutrition in proper combination. All those, therefore, that are purely starchy in character, such as arrowroot, corn-flour, and the like, should be avoided; while those that contain nitrogenous as well as starchy elements may be safely given. Of the latter the entire wheat flour, which contains the husks ground down with the wheat, generally answers admirably; and of the same character are rusks, tops and bottoms, Liebig's infant's food, and many others. If the child be pale and flabby, some more purely animal food may often be given once a day, and great benefit may be derived from a single meal of beef-, chicken-, or veal-tea, with a little bread-crumb in it, especially after the sixth or seventh month. Milk, however, should still form the main article of diet, and should continue to do so for many months.

If the child be pale, flabby, and do not gain flesh, more especially if diarrhœa or other intestinal disturbance be present, we may be certain that the attempt at hand-feeding is not answering satisfactorily, and that some change is required. If the child be not too old, and will still take the breast, that is certainly the best remedy; but, if that be not possible, it is necessary to alter the system of diet. When milk disagrees, cream, in the proportion of one tablespoonful to three of water, sometimes answers well. Occasionally also Liebig's infant's food, when carefully prepared, renders good service. Too often, however, when once diarrhœa or other intestinal disturbance has set in, all our efforts may prove unavailing, and the health, if not the life, of the infant becomes seriously imperilled. It is not, however, within the scope of this work to treat of the disorders of infants at the breast, the proper consideration of which requires a large amount of space; and I therefore refrain from making any further remarks on the subject.

CHAPTER III.

PUERPERAL ECLAMPSIA.

BY the term *puerperal eclampsia* is meant a peculiar kind of epileptiform convulsions, which may occur in the latter months of pregnancy, or during or after parturition, and which constitutes one of the most formidable diseases with which the obstetrician has to cope. The attack is often so sudden and unexpected, so terrible in its nature, and attended with such serious danger both to the mother and child, that it has naturally attracted much attention.

The researches of Lever, Braun, Frerichs, and many other writers who have shown the frequent association of eclampsia with albuminuria, have, of late years, been supposed to clear up to a great extent the etiology of this disease, and to prove its dependence on the retention of urinary elements in the blood. While the urinary origin of eclampsia has been pretty generally accepted, more recent observations have tended to throw some doubt on its essential dependence on this cause; so that it can hardly be said that we are yet in a position to explain its true pathology with certainty. These points will require separate discussion; but it is first necessary to describe the character and history of the attack.

Considerable confusion exists in the description of puerperal convulsions, from the confounding of several essentially distinct diseases under the same name. Thus, in most obstetric works it has been customary to describe three distinct classes of convulsion: the *epileptic*, the *hysterical*, and the *apoplectic*. The two latter, however, come under a totally different category. A pregnant woman may suffer from hysterical paroxysms, or she may be attacked with apoplexy accompanied with coma and followed by paralysis. But these conditions in the pregnant or parturient woman are identical with the same diseases in the non-pregnant, and are in no way special in their nature. True eclampsia, however, is different in its clinical history from epilepsy; although the paroxysms, while they last, are essentially the same as those of an ordinary epileptic fit.

Premonitory Symptoms.—An attack of eclampsia seldom occurs without having been preceded by certain more or less well-marked precursory symptoms. It is true that in a considerable number of cases these are so slight as not to attract attention, and suspicion is not aroused until the patient is seized with convulsions. Still, subsequent investigations will very generally show that some symptoms did exist, which, if observed and properly interpreted, might have put the practitioner on his guard, and possibly enabled him to ward off the attack. Hence a knowledge of them is of real practical value. The most common are those associated with the cerebrum, such as severe headache, which is the one most generally observed, and is sometimes limited to one side of the head. Transient attacks of dizziness, spots before the eyes, loss of sight, or impairment of the intellectual faculties, are also not uncommon. These signs in a pregnant woman are of the gravest import, and should at once call for investigation into the nature of the case. Less marked indications sometimes exist in the form of irritability, slight headache or stupor, and a general feeling of indisposition. Another important premonitory sign is œdema of the subcutaneous cellular tissue, especially of the face or upper extremities, which should at once lead to a careful examination of the urine.

Symptoms of the Attack.—Whether such indications have preceded an attack or not, as soon as the convulsion comes on there can no longer be any doubt as to the nature of the case. The attack is generally sudden in its onset, and in its character is precisely that of a severe epileptic fit, or of the convulsions in children. Close observation shows that there is at first a short period of tonic spasm, affecting the entire muscular system. This is almost immediately succeeded by violent clonic contractions, generally commencing in the muscles of the face, which twitch violently; the expression is horribly altered; the globes of the eyes are turned up under the eyelids, so as to leave only the white sclerotics visible, and the angles of the mouth are retracted and fixed in a convulsive grin. The tongue is at the same time protruded forcibly, and, if care be not taken, is apt to be lacerated by the violent grinding of the teeth. The face, at first pale, soon becomes livid and cyanosed, while the veins of the neck are distended, and the carotids beat vigorously. Frothy saliva collects about the mouth, and the whole appearance is so changed as to render the patient quite unrecognizable. The convulsive movements soon attack the muscles of the body. The hands and arms, at first rigidly fixed, with the thumbs clenched into the palms, also begin to jerk, and the whole muscular system is thrown into rapidly-recurring convulsive spasms. It is evident that the involuntary muscles are implicated in the convulsive action, as well as in the voluntary. This is shown by a temporary arrest of respiration at the commencement of the attack, followed by irregular and hurried respiratory movements, producing a peculiar hissing sound. The occasional involuntary expulsion of urine and fæces indicates the same fact. During the attack the patient is absolutely unconscious, sensibility is totally suspended, and she has afterwards no recollection of what has taken place. Fortunately, the convulsion is not of long duration, and, at the outside, does not last more than three or four minutes, generally not so long. In most cases, however, after an interval, there is a recurrence of the convulsion, characterized by the same phenomena, and these paroxysms are repeated with more or less force and frequency according to the severity of the attack. Sometimes several hours may elapse before a second convulsion comes on; at others the attacks may recur very often, with only a few minutes between them. In the slighter forms of eclampsia there may not be more than 2 or 3 paroxysms in all; in the more serious as many as 50 or 60 have been recorded.

Condition between the Attacks.—After the first attack the patient generally soon recovers her consciousness, being somewhat dazed and somnolent, with no clear perception of what has occurred. If the paroxysms be frequently repeated, more or less profound coma continues in the intervals between them, which, no doubt, depends upon intense cerebral congestion, resulting from the interference with the circulation in the great veins of the neck, produced by spasmodic contraction of the muscles. The coma is rarely complete, the patient showing signs of sensibility when irritated, and groaning during the uterine contractions. In the worst class of cases, the torpor may become intense and continuous, and in this state the patient may die. When the convulsions have entirely stopped, and the patient has completely regained her consciousness, and is apparently convalescent, recollection of what has taken place during, and some time before, the attack, may be entirely lost, and this condition may last for a considerable time. A curious instance of this once came under my notice in a lady who had lost a brother, to whom she was greatly attached, in the week immediately preceding her confinement, and in whom the mental distress seemed to have had a good deal to do in determining the attack. It was many weeks before she recovered her memory, and during that time she recollected nothing about the circumstances connected with her brother's death, the whole of that week being, as it were, blotted out of her recollection.

Relation of the Attacks to Labor.—If the convulsions come on during pregnancy, we may look upon the advent of labor as almost a certainty; and, if we consider the severe nervous shock and general disturbance, this is the result we might reasonably anticipate. If they occur, as is not uncommon, for the first time during labor, the pains generally continue with increased force and frequency, since the uterus partakes of the convulsive action, as well as the other muscles of the body. It has not rarely happened that the pains have gone on with such intensity that the child has been born quite unexpectedly, while the attention of the practitioner has been taken up with the patient. In many cases the advent of fresh paroxysms is associated with the commencement of a pain, the irritation of which seems sufficient to bring on the convulsion.

Results to the Mother and Child.—The results of eclampsia vary according to the severity of the paroxysms. It is generally said that about 1 in 3 or 4 cases dies. The mortality has certainly lessened of late years, probably in consequence of improved knowledge of the nature of the disease, and more rational modes of treatment. This is well shown by Barker,[1] who found in 1855 a mortality of 32 per cent. in cases occurring before and during labor, and 22 per cent. in those after labor; while since that date the mortality has fallen to 14 per cent. The same conclusion is arrived at by Dr. Phillips,[2] who has shown that the mortality has greatly lessened since the practice of repeated and indiscriminate bleeding, long considered the sheet-anchor in the disease, has been discontinued, and the administration of chloroform substituted. Death may actually occur during the paroxysm, and then it may be due to the long continuance of the tonic spasm producing asphyxia. It is certain that, as long as the tonic spasm lasts, the respiration is suspended, just as in the convulsive disease of children known as laryngismus stridulus, and it is possible also that the heart itself may share in the convulsive contraction which is known to affect other involuntary muscles. More frequently, death happens at a later period, from the combined effects of exhaustion and asphyxia. The records of post-mortem examinations are not numerous; in those we possess, the principal changes have been an anæmic condition of the brain, with some œdematous infiltration. In a few rare cases the convulsions have resulted in effusion of blood into the ventricles, or on the base of the brain. The prognosis as regards the child is also serious. Out of 36 children, Hall Davis found 26 born alive, 10 being still-born. There is good reason to believe that the convulsion may attack the child in utero; of this several examples are mentioned by Cazeaux; or it may be subsequently attacked with convulsions, even when apparently healthy at birth.

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[1] The Puerperal Diseases, p. 125.

[2] Guy's Hosp. Rep., 1870.

Pathology of the Disease.—The precise pathology of eclampsia cannot be considered by any means satisfactorily settled. When, in the year 1843, Lever first showed that the urine in patients suffering from puerperal convulsions was generally highly charged with albumen—a fact which subsequent experience has amply confirmed—it was thought that a key to the etiology of the disease had been found. It was known that chronic forms of Bright's disease were frequently associated with retention of urinary elements in the blood, and not rarely accompanied by convulsions. The natural inference was drawn, that the convulsions of eclampsia were also due to toxæmia resulting from the retention of urea in the blood, just as in the uræmia of chronic Bright's disease; and this view was adopted and supported by the authority of Braun, Frerichs, and many other writers of eminence, and was pretty generally received as a satisfactory explanation of the facts. Frerichs modified it so far, that he held that the true toxic element was not urea as such, but carbonate of ammonia, resulting from its decomposition; and experiments were made to prove that the injection of this substance into the veins of the lower animals produced convulsions of precisely the same character as eclampsia. Dr. Hammond,[1] of Maryland, subsequently made a series of counter-experiments, which were held as proving that there was no reason to believe that urea ever did become decomposed in the blood in the way that Frerichs supposed, or that the symptoms of uræmia were ever produced in this way. Spiegelberg[2] has, more recently, again examined the question, both clinically, in a patient suffering from convulsions, in whose blood an excess of ammonia and urea was found, and by experiments in dogs, and maintains the accuracy of Frerichs's views. Others have believed that the poisonous elements retained in the blood are not urea or the products of its decomposition, but other extractive matters which have escaped detection. As time elapsed, evidence accumulated to show that the relation between albuminuria and eclampsia was not so universal as was supposed, or at least that some other factors were necessary to explain many of the cases. Numerous cases were observed in which albumen was detected in large quantities, without any convulsion following, and that not only in women who had been the subject of Brigh [illegible] efore conception, but also when the albuminuria was known to have developed during pregnancy. Thus, Imbert Goubeyre found that out of 164 cases of the latter kind, 95 had no eclampsia; and Blot, out of 41 cases, found that 34 were delivered without untoward symptoms. It may be taken as proved, therefore, that albuminuria is by no means necessarily accompanied by eclampsia. Cases also were observed in which the albumen only appeared after the convulsion; and in these it was evident that the retention of urinary elements could not have been the cause of the attack; and it is highly probable that in them the albuminuria was produced by the same cause which induced the convulsion. Special attention has been called to this class of cases by Braxton Hicks,[1] who has recorded a considerable number of them. He says that the nearly simultaneous appearance of albuminuria and convulsion—and it is admitted that the two are almost invariably combined—must then be explained in one of three ways:

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[1] Amer. Journ., 1861.

1st. That the convulsions are the cause of the nephritis.

2dly. That the convulsions and the nephritis are produced by the same cause, *e.g.* some detrimental ingredient circulating in the blood, irritating both the cerebro-spinal system and other organs at the same time.

3dly. That the highly congested state of the venous system, induced by the spasm of the glottis in eclampsia, is able to produce the kidney complication.

More recently, Traube and Rosenstein have advanced a theory of eclampsia purporting to explain these anomalies. They refer the occurrence of eclampsia to acute cerebral anæmia, resulting from changes in the blood incident to pregnancy. The primary factor in this is the hydræmic condition of the blood, which is an ordinary concomitant of the pregnant state, and, of course, when there is also albuminuria, the watery condition of the blood is greatly intensified; hence the frequent association of the two states. Accompanying this condition of the blood there is increased tension of the arterial system, which is favored by the hypertrophy of the heart which is known to be a normal occurrence in pregnancy. The result of these combined states is a temporary hyperæmia of the brain, which is rapidly succeeded by serous effusion into the cerebral tissues, resulting in pressure on its minute vessels, and consequent anæmia. There is much in this theory that accords with the most recent views as to the etiology of convulsive disease; as, for example, the researches of Kussmaul and Tenner, who have experimentally proved the dependence of convulsion on cerebral anæmia, and of Brown-Séquard, who showed that an anæmic condition of the nerve-centres preceded an epileptic attack. It explains also very satisfactorily how the occurrence of labor should intensify the convulsions, since during the acme of the pains the tension of the cerebral arterial system is necessarily greatly increased. There are, however, obvious difficulties against its general acceptance. For example, it does not satisfactorily account for those cases which are preceded by well-marked precursory symptoms, and in which an abundance of albumen is present in the urine. Here the premonitory signs are precisely those which precede the development of uræmia in chronic Bright's disease, the dependence of which on the retention in the blood of urinary elements can hardly be doubted.

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[1] Obst. Trans., vol. viii.

The key to the liability of the puerperal woman to convulsive attacks is, no doubt, to be found in the peculiar excitable condition of the nervous system in pregnancy—a fact which was clearly pointed out by the late Dr. Tyler Smith, and by many other writers. Her nervous system is, in this respect, not unlike that of children, in whom the predominant influence and great excitability of the nervous system is a well-established fact, and in whom precisely similar convulsive seizures are of common occurrence on the application of a sufficiently exciting cause.

Exciting Causes.—Admitting this, we require some cause to set the predisposed nervous system into morbid action; and this we may have either in a toxæmic or in an extremely watery condition of the blood, associated with albuminuria; or, along with these, or sometimes independently of them, in some excitement, such as strong emotional disturbance. It is highly probable, however, that the theory of Traube affords a true insight into the actual condition of the nerve-centres—a fact of much practical importance in reference to treatment.

Treatment.—The management of cases in which the occurrence of suspicious symptoms has led to the detection of albuminuria has already been fully discussed (p. 184). We shall, therefore, here only consider the treatment of cases in which convulsions have actually occurred.

Venesection.—Until quite recently, venesection was regarded as the sheet-anchor in the treatment, and blood was always removed copiously, and, there is sufficient reason to believe, with occasional remarkable benefit. Many cases are recorded in which a patient, in apparently profound coma, rapidly regained her consciousness when blood was extracted in sufficient quantity. The improvement, however, was often transient, the convulsions subsequently recurring with increased vigor. There are good theoretical grounds for believing that blood-letting can only be of merely temporary use, and may even increase the tendency to convulsion. These are so well put by Schroeder that I cannot do better than quote his observations on this point. "If," he says, "the theory of Traube and Rosenstein be correct, a sudden depletion of the vascular system, by which the pressure is diminished, must stop the attacks. From experience it is known that after venesection the quantity of blood soon becomes the same through the serum taken from all the tissues, while the quality is greatly deteriorated by the abstraction of blood. A short time after venesection we shall expect to find the former blood-pressure in the arterial system, but the blood far more watery than previously. From this theoretical consideration it follows that abstraction of blood, if the above-mentioned conditions really cause convulsions, must be attended by an immediate favorable result, and, under certain circumstances, the whole disease may surely be cut short by it. But, if all other conditions remain the same, the blood-pressure will after some time again reach its former height. The quantity of blood has, in the mean time, been greatly deteriorated, and consequently the danger of the disease will be increased."

These views sufficiently well explain the varying opinions held with regard to this remedy, and enable us to understand why, while the effects of venesection have been so lauded by certain authors, the mortality has admittedly been much lessened since its indiscriminate use has been abandoned. It does not follow because a remedy, when carried to excess, is apt to be hurtful, that it should be discarded altogether; and I have no doubt that, in properly selected cases, and judiciously employed, venesection is a valuable aid in the treatment of eclampsia, and that it is specially likely to be useful in mitigating the first violence of the attack, and in giving time for other remedies to come into action. Care should, however, be taken to select the cases properly; and it will be specially indicated when there is marked evidence of great cerebral congestion and vascular tension, such as a livid face, a full bounding pulse, and strong pulsation in the carotids. The general constitution of the patient may also serve as a guide in determining its use, and we shall be the more disposed to resort to it if the patient be a strong and healthy woman; while, on the other hand, if she be feeble and weak we may wisely discard it, and trust entirely to other means. In any case, it must be looked upon as a temporary expedient only—useful in warding off immediate danger to the cerebral tissues, but never as the main agent in treatment. Nor can it be permissible to bleed in the heroic manner frequently recommended. A single bleeding, the amount regulated by the effect produced, is all that is ever likely to be of service.

Compression of the Carotids.—As a temporary expedient, having the same object in view, the compression of the carotids during the paroxysm is worthy of trial. This was proposed by Trousseau in the eclampsia of infants, but I am not aware that it has been tried in puerperal convulsions. It is a simple measure, and it offers the advantage of not leading to any permanent deterioration of the blood, as in venesection.

Administration of Purgatives.—As a subsidiary means of diminishing vascular tension, the administration of a strong purgative is desirable, and has the further effect of removing any irritant matter that may be lodged in the intestinal tract. If the patient be conscious, a full dose of the compound jalap powder may be given, or a few grains of calomel combined with jalap; and if she be comatose, and unable to swallow, a drop of croton-oil, or a quarter of a grain of elaterium, may be placed on the back of the tongue.

Administration of Sedatives and Narcotics.—The great indication in the management of eclampsia is the controlling of convulsive action by means of sedatives. Foremost amongst them must be placed the inhalation of chloroform, a remedy which is frequently remarkably useful, and which has the advantage of being applicable at all stages of the disease, and whether the patient be comatose or not. Theoretical objections have been raised against its employment, as being likely to increase cerebral congestion, of which there is no satisfactory proof; on the contrary, there is reason to think that chloroform inhalation has rather the effect of lessening arterial tension, while it certainly controls the violent muscular action by which the vascular hyperæmia is so much increased. Practically, no one who has used it can doubt its great value in diminishing the force and frequency of the convulsive paroxysms. Statistically, its usefulness is shown by Charpentier, in his thesis on the effects of various methods of treatment in eclampsia, since out of 63 cases in which it was used, in 48 it had the effect of diminishing or arresting the attacks, 1 only proving fatal. The mode of administration has varied. Some have given it almost continuously, keeping the patient in a more or less profound state of anæsthesia. Others have contented themselves with carefully watching the patient, and exhibiting the chloroform as soon as there were any indications of a recurring paroxysm, with a view of controlling its intensity. The latter is the plan I have myself adopted, and of the value of which, in most cases, I have no doubt. Every now and again, cases will occur in which chloroform inhalation is insufficient to control the paroxysm, or in which, from the very cyanosed state of the patient, its administration seems contra-indicated. Moreover, it is advisable to have, if possible, some remedy more continuous in its action, and requiring less constant personal supervision. Latterly the internal administration of chloral has been recommended for this purpose. My own experience is decidedly in its favor, and I have used, as I believe, with marked advantage a combination of chloral with bromide of potassium, in the proportion of twenty grains of the former to half a drachm of the latter, repeated at intervals of from four to six hours. If the patient be unable to swallow, the chloral may be given in an enema. The remarkable influence of bromide of potassium in controlling the eclampsia of infants would seem to be an indication for its use in puerperal cases. Fordyce Barker is opposed to the use of chloral, which he thinks excites instead of lessening reflex irritability.[1] Another form of narcotic, not entirely free from theoretical objections, but strongly recommended by those who have used it, is the subcutaneous injection of morphia, which has the advantage of being applicable when the patient is quite unable to swallow. This may be given in doses of one-third of a grain, repeated in a few hours, so as to keep the patient well under its influence. It is to be remembered that the object is to control muscular action, so as to prevent, as much as possible, the violent convulsive paroxysm, and therefore it is necessary that the narcosis, however produced, should be continuous. It is rational, therefore, to combine the intermittent action of chloroform with the more continuous action of other remedies, so that the former should supplement the latter when insufficient.

Other remedies, supposed to act in the way of antidotes to uræmic poisoning, have been advised, such as acetic or benzoic acid; but they are far too uncertain to have any reliance placed on them, and they distract attention from more useful measures.

Certain precautions are necessary during the fits to prevent the patient injuring herself, especially to obviate the laceration of the tongue; the latter can be best done by placing something between the teeth as the paroxysm comes on, such as the handle of a teaspoon enveloped in several folds of flannel.

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[1] The P[illegible]seases, p. 120.

The *obstetric management* of eclampsia will naturally give rise to much anxiety, and on this point there has been considerable difference of opinion. On the one hand, we have practitioners who advise the immediate emptying of the uterus, even when labor has not commenced; on the other, those who would leave the labor entirely alone. Thus, Gooch said, "attend to the convulsions, and leave the labor to take care of itself;" and Schroeder says, "especially no kind of obstetric manipulation is required for the safety of the mother," admitting, however, that it is sometimes advisable to hasten the labor to ensure the safety of the child.

In cases in which the convulsions come on during labor, the pains are often strong and regular, the labor progresses satisfactorily, and no interference is needful. In others we cannot but feel that the emptying of the uterus would be decidedly beneficial. We have to reflect, however, that any active interference with the uterus might of itself prove very irritating, and excite fresh attacks. The influence of uterine irritation is apparent by the frequency with which the paroxysms recur with the pains. If, therefore, the os be undilated, and labor have not begun, no active means to induce it should be adopted, although the membranes may be ruptured with advantage, since that procedure tends to no irritation. Forcible dilatation of the os, and especially turning, are strongly contra-indicated.

The rule laid down by Tyler Smith seems that which is most advisable to follow—that we should adopt the course which seems least likely to prove a source of irritation to the mother. Thus, if the fits seem evidently induced and kept up by the pressure of the fœtus, and the head be within reach, the forceps or even craniotomy may be resorted to. But if, on the other hand, there be reason to think that the operation necessary to complete delivery is likely *per se* to prove a greater source of irritation than leaving the case to nature, then we should certainly not interfere.

CHAPTER IV.

PUERPERAL INSANITY.

UNDER the head of "*Puerperal Mania*" writers on obstetrics have indiscriminately classed all cases of mental disease connected with pregnancy and parturition. The result has been unfortunate, for the distinction between the various types of mental disorder has, in consequence, been very generally lost sight of. But little study of the subject suffices to show that the term Puerperal Mania is wrong in more ways than one, for we find that a large number of cases are not cases of "mania" at all, but of melancholia; while a considerable number are not, strictly speaking, "puerperal," as they either come on during pregnancy, or long after the immediate risks of the puerperal period are over, being in the latter case associated with anæmia produced by over-lactation. For the sake of brevity, the generic term of "*Puerperal Insanity*" may be employed to cover all cases of mental disorder connected with gestation, while they may be further conveniently subdivided into three classes, each of which has its special characteristics, viz.:

I. The *Insanity of Pregnancy.*

II. *Puerperal Insanity,* properly so called—that is, insanity coming on within a limited period after delivery.

III. The *Insanity of Lactation.*

This division is a strictly natural one, and includes all the cases likely to come under observation. The relative proportion these classes bear to each other can only be determined by accurate statistical observations on a large scale, the materials for which we do not possess. The returns from large asylums are obviously open to objection, for only the worst and most confirmed cases find their way into these institutions, while by far the greater proportion, both before and after labor, are treated in their own homes.

/5 /7 Taking such returns as only approximative, we find from Dr. Batty Tuke[1] that, in the Edinburgh Asylum, out of 1~~0~~5 cases of puerperal insanity, 28 occurred before delivery, ~~1~~3 during the puerperal period, and 54 during lactation. The relative proportion of each per hundred is as follows:

Insanity of Pregnancy,	18.06	per cent.
Puerperal Insanity,	47.09	"
Insanity of Lactation,	34. 8	"

Marcé[2] collects together several series of cases from various authorities, amounting to 310 in all, and the results are not very different from those of the Edinburgh Asylum, except in the relatively smaller number of cases occurring before delivery. The percentages calculated from his figures are:

Insanity of Pregnancy,	8.06	per cent.
Puerperal Insanity,	58.06	"
Insanity of Lactation,	30.30	"

As each of these classes differs in various important respects from the others, it will be better to consider each separately.

The *Insanity of Pregnancy* is, without doubt, the least common of the three forms. The intense mental depression which in many women accompanies pregnancy, and causes the patient to take a desponding view of her condition, and to look forward to the result of her labor with the most gloomy apprehension, seems to be often only a lesser degree of the actual mental derangement which is occasionally met with. The relation between the two states is further borne out by the fact that a large majority of cases of insanity during pregnancy are well-marked types of melancholia; out of 28 cases, reported by Tuke, 15 were examples of pure melancholia, 5 of dementia with melancholia. In many of these the attack could be traced as developing itself out of the ordinary hypochondriasis of pregnancy. In others the symptoms came on at a later period of pregnancy, the earlier months of which had not been marked by any unusual lowness of spirits. The age of the patient seems to have some influence, the proportion of cases between 30 and 40 years of age being much larger than in younger women. A larger proportion of cases occurs in primiparæ than in multiparæ, a fact that, no doubt, depends on the greater dread and apprehension experienced by women who are pregnant for the first time, especially if not very young. Hereditary disposition plays an important part, as in all forms of puerperal insanity. It is not always easy to ascertain the fact of an hereditary taint, since it is often studiously concealed by the friends. Tuke, however, found distinct evidence of it in no less than 12 out of 28 cases. Fürstner[1] believes that other neuroses have an important influence in the causation of the disease. Out of 32 cases he found direct hereditary taint in 9, but in 11 more there was a family history of epilepsy, drunkenness, or hysteria.

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[1] Edin. Med. Journ., vol. x.

[2] Traité de la Folie des Femmes enceintes.

The period of pregnancy at which mental derangement most commonly shows itself varies. Most generally, perhaps, it is at the end of the third or the beginning of the fourth month. It may, however, begin with conception, and even return at every impregnation. Montgomery relates an instance in which it recurred in three successive pregnancies. Marcé distinguishes between true insanity coming on during pregnancy, and aggravated hypochondriasis, by the fact that the latter usually lessens after the third month, while the former most commonly only begins after that date. It is unquestionable that in many cases no such distinction can be made, and that the two are often very intimately associated.

The *form of insanity* does not differ from ordinary melancholia. The suicidal tendency is generally very strongly developed. Should the mental disorder continue after delivery, the patient may very probably experience a strong impulse to kill her child. Moral perversions have been not uncommonly observed. Tuke especially mentions a tendency to dipsomania in the early months, even in women who have not shown any disposition to excess at other times. He suggests that this may be an exaggeration of the depraved appetite, or morbid craving, so commonly observed in pregnant women, just as melancholia may be a further development of lowness of spirits. Laycock mentions a disposition to "kleptomania" as very characteristic of the disease. Cooper[2] relates a curious case where this occurred in a pregnant lady of rank, and the influence of pregnancy in developing an irresistible tendency was pleaded in a criminal trial in which one of her petty thefts had involved her.

The *prognosis* may be said to be, on the whole, favorable. Out of Dr. Tuke's 28 cases, 19 recovered within six months. There is little hope of a cure until after the termination of the pregnancy, as out of 19 cases recorded by Marcé only in 2 did the insanity disappear before delivery.

Transient Mania during Delivery.—There is a peculiar form of mental derangement sometimes observed during labor, which is by some talked of as a temporary insanity. It may, perhaps, be more accurately described as a kind of acute delirium, produced, in the latter stage of labor, by the intensity of the suffering caused by the pains. According to Montgomery, it is most apt to occur as the head is passing through the cervix, or, at a later period, during the expulsion of the child. It may consist of merely a loss of control over the mind, during which the patient, unless carefully watched, might, in her agony, seriously injure herself or her child. Sometimes it produces actual hallucination, as in the case described by Tarnier, in which the patient fancied she saw a spectre standing at the foot of her bed, which she made violent efforts to drive away. This kind of mania, if it may be so called, is merely transitory in its character, and disappears as soon as the labor is over. From a medico-legal point of view it may be of importance, as it has been held by some that in certain cases of infanticide the mother has destroyed the child when in this state of transient frenzy, and when she was irresponsible for her acts. In the treatment of this variety of delirium we must, of course, depend on lessening the intensity of the suffering; and it is in such cases that chloroform will find one of its most valuable applications.

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[1] Archiv für Psychiatrie, Band v. Heft 2.

[2] Cooper's Forensic Medicine, vol. iv.

True puerperal insanity has always attracted much attention from obstetricians, often to the exclusion of other forms of mental disturbance connected with the puerperal state. We may define it to be that form of insanity which comes on within a limited period after delivery, and which is probably intimately connected with that process. Out of 73 examples of the disease tabulated by Dr. Tuke, only 2 came on later than a month after delivery, and in these there were other causes present, which might possibly remove them from this class.

Although a large number of these cases assume the character of acute mania, that is by no means the only kind of insanity which is observed, a not inconsiderable number being well-marked examples of melancholia. The distinction between them was long ago pointed out by Gooch, whose admirable monograph on the disease contains one of the most graphic and accurate accounts of puerperal insanity that has yet been written.

There are also some peculiarities as to the period at which these varieties of insanity show themselves, which, taken in connection with certain facts in their etiology, may eventually justify us in drawing a stronger line of demarcation between them than has been usual. It appears that cases of acute mania are apt to come on at a period much nearer delivery than melancholia. Thus, Tuke found that all the cases of mania came on within 16 days after delivery, and that all the cases of melancholia developed themselves after that period. We shall presently see that one of the most recent theories as to the causation of the disease attributes it to some morbid condition of the blood. Should farther investigation confirm this supposition, inasmuch as septic conditions of the blood are most likely to occur a short time after labor, it would not be an improbable hypothesis that cases of acute mania, occurring within a short time after labor, may depend on such septic causes, while melancholia is more likely to arise from general conditions favoring the development of mental disease. This must, however, be regarded as a mere speculation requiring further investigation.

Causes.—Hereditary predisposition is very frequently met with, and a careful enquiry into the patient's history will generally show that other members of the family have suffered from mental derangement. Reid found that out of 111 cases in Bethlehem Hospital there was clear evidence of hereditary taint in 45. Tuke made the same observation in 22 out of his 73 cases; and, indeed, it is pretty generally admitted by all alienist physicians that hereditary tendencies form one of the strongest predisposing causes to mental disturbance in the puerperal state. In a large proportion of cases, circumstances producing debility and exhaustion, or mental depression, have preceded the attack. Thus, it is often found that patients attacked with it have had post-partum hemorrhage, or have suffered from some other conditions producing exhaustion, such as severe and complicated labor; or they may have been weakened by over-frequent pregnancies, or by lactation during the early months of pregnancy. Indeed, anæmia is always well marked in this disease. Mental conditions also are frequently traceable in connection with its production. Morbid dread during pregnancy, insufficient to produce insanity before delivery, may develop into mental derangement after it. Shame and fear of exposure in unmarried women not unfrequently lead to it, as is evidenced by the fact that out of 2281 cases, gathered from the reports of various asylums, above 64 per cent. were unmarried.[1] Sudden moral shocks or vivid mental impressions may be the determining cause in predisposed persons. Gooch narrates an example of this in a lady who was attacked immediately after a fright produced by a fire close to her house, the hallucinations in this case being all connected with light; and Tyler Smith that of another whose illness dated from the sudden death of a relative. The age of the patient has some influence, and there seems to be a decidedly greater liability at advanced ages, especially when such women are pregnant for the first time.

The possibility of the acute form of puerperal insanity, coming on shortly after delivery, being dependent on some form of septicæmia, is one which deserves careful consideration. The idea originated with Sir James Simpson, who found albumen in the urine of 4 patients. He suggested that this might probably indicate the presence in the blood of certain urinary constituents, which might have determined the attack, much in the same way as in eclampsia. Dr. Donkin subsequently wrote an important paper,[2] in which he warmly supported this theory, and arrived at the conclusion "that the acute dangerous class of cases are examples of uræmic blood-poisoning, of which the mania, rapid pulse, and other constitutional symptoms are merely the phenomena; and that the affection, therefore, ought to be termed uræmic or renal puerperal mania, in contradistinction to the other form of the disease." He also suggests that the immediate poison may be carbonate of ammonia, resulting from the decomposition of urea retained in the blood. It will be observed, therefore, that the pathological condition producing puerperal mania would, supposing this theory to be correct, be precisely the same as that which, at other times, gives rise to puerperal eclampsia. There can be no doubt that the patient, immediately after delivery, is in a condition rendering her peculiarly liable to various forms of septic disease; and it must be admitted that there is no inherent improbability in the supposition that some morbid material circulating in the blood may be the effective cause of the attack, in a person otherwise predisposed to it. It is also certain, as I have already pointed out, that there are two distinct classes of cases, differing according to the period after delivery at which the attack comes on. Whether this difference depends on the presence in the blood of some septic matter—especially retained urinary excreta—is a question which our knowledge by no means justifies us in answering. Unquestionably it is one which well merits further careful study.

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[1] Journal of Mental Science, 1870-1, p. 159.

[2] Edin. Med. Journ., vol. viii.

It is only fair to point to some difficulties which appear to militate against the view which Dr. Donkin maintains. In the first place, the albuminuria is merely transient, while its supposed effects last for weeks or months. Sir James Simpson says, with regard to his cases, "I have seen all traces of albuminuria in puerperal insanity disappear from the urine within fifty hours of the access of the malady. The general rapidity of its disappearance is, perhaps, the principal, or, indeed, the only reason why this complication has escaped the notice of those physicians among us who devote themselves with such ardor and zeal to the treatment of insanity in our public asylums." This apparent anomaly Simpson attempts to explain by the hypothesis that when once the uræmic poisoning has done its work, and set the disease in progress, the mania progresses of itself. This, however, is pure speculation; and in the supposed analogous case of eclampsia the albuminuria certainly lasts as long as its effects. It is not easy to understand, also, why uræmic poisoning should in one case give rise to insanity, and in another to convulsions. For all we know to the contrary, transient albuminuria may be much more common after delivery than has been generally supposed; and further investigation on this point is required. It has, of late years, been shown that albumen is by no means unfrequent, for a short time, in various conditions of the body, without any serious consequences, as, for example, after bathing; and we might too readily draw an unjustifiable conclusion from its detection in a few cases of mania. There are, however, many other kinds of blood-poisoning, besides uræmia, which may have an influence in the production of the disease; and it is to be hoped that future observations may enable us to speak with more certainty on this point.

The *prognosis* of puerperal insanity is a point which will always deeply interest those who have to deal with so distressing a malady. It may resolve itself into a consideration of the immediate risk to life, and of the chances of ultimate restoration of the mental faculties. It is an old aphorism of Gooch's, and one the correctness of which is justified by modern experience, that "mania is more dangerous to life, melancholia to reason." It has very generally been supposed that the immediate risk to life in puerperal mania is not great; and, on the whole, this may be taken as correct. Tuke found that death took place from all causes in 10.9 per cent. of the cases under observation; these, however, were all women who had been admitted into asylums, and in whom the attack may be assumed to have been exceptionally severe. Great stress was laid by Hunter and Gooch on extreme rapidity of the pulse, as indicating a tendency to death. There can be no doubt that it is a symptom of great gravity, but by no means one which need lead us to despair of our patient's recovery. The most dangerous class of cases are those attended with some inflammatory complication; and if there be marked elevation of temperature, indicating the presence of some such concomitant state, our prognosis must be more grave than when there is mere excitement of the circulation.

There are no marked post-mortem signs found in fatal cases to guide us in forming an opinion as to the nature of the disease. "No constant morbid changes," says Tyler Smith, "are found within the head, and most frequently the only condition found in the brain is that of unusual paleness and exsanguinity. Many pathologists have also remarked upon the extremely empty condition of the blood-vessels, particularly the veins."

The *duration of the disease* varies considerably. Generally speaking, cases of mania do not last so long as melancholia, and recovery takes place within a period of three months, often earlier. Very few of the cases admitted into the Edinburgh Asylum remained there more than six months, and after that time the chances of ultimate recovery greatly lessened. When the patient gets well, it often happens that her recollection of the events occurring during her illness is lost; at other times, the delusions from which she suffered remain—as, for example, in a case which was under my care, in which the personal antipathies which the patient formed when insane became permanently established.

Insanity of Lactation.—54 out of the 155 cases collected by Dr. Tuke were examples of the insanity of lactation, which would appear, therefore, to be nearly twice as common as that of pregnancy, but considerably less so than the true puerperal form. Its dependence on causes producing anæmia and exhaustion is obvious and well marked. In the large majority of cases it occurs in multiparæ who have been debilitated by frequent pregnancies and by length of nursing. When occurring in primiparæ, it is generally in women who have suffered from post-partum hemorrhage or other causes of exhaustion, or whose constitution was such as should have contra-indicated any attempt at lactation. The bruit-de-diable is almost invariably present in the veins of the neck, indicating the impoverished condition of the blood.

The type is far more frequently melancholic than maniacal, and when the latter form occurs, the attack is much more transient than in true puerperal insanity. The danger to life is not great, especially if the cause producing debility be recognized and at once removed. There seems, however, to be more risk of the insanity becoming permanent than in the other forms. In 12 out of Dr. Tuke's cases the melancholia degenerated into dementia, and the patient became hopelessly insane.

The *symptoms* of these various forms of insanity are practically the same as in the non-pregnant state.

Generally in cases of mania there is more or less premonitory indication of mental disturbance, which may pass unperceived. The attack is often preceded by restlessness and loss of sleep, the latter being a very common and well-marked symptom; or, if the patient do sleep, her rest is broken and disturbed by dreams. Causeless dislikes to those around her are often observed; the nurse, the husband, the doctor, or the child, become the objects of suspicion, and, unless proper care be taken, the child may be seriously injured. As the disease advances, the patient becomes incoherent and rambling in her talk, and, in a fully-developed case, she is incessantly pouring forth an unconnected jumble of sentences, out of which no meaning can be made. Often some prevalent idea which is dwelling in the patient's mind can be traced running through her ravings; and it has been noticed that this is frequently of a sexual character, causing women of unblemished reputation to use obscene and disgusting language, which it is difficult to understand their even having heard. The tendency of such patients to make accusations impugning their own chastity was specially insisted on by many eminent authorities in a recent celebrated trial, when Sir James Simpson stated that in his experience "the organ diseased gave a type to the insanity, so that with women suffering from affections of the genital organs the delusions would be more likely to be connected with sexual matters." Religious delusions, as a fear of eternal damnation, or of having committed some unpardonable sin, are of frequent occurrence, but perhaps more often in cases which are tending to the melancholic type. Associated with this marked mental disturbance there is generally intolerable restlessness, and the patient's whole manner and appearance are those of excessive excitement. She may refuse to remain in bed, may tear off her clothes, or attempt to injure herself. The suicidal tendency is often very marked. In one case under my care, the patient made incessant efforts to destroy herself, which were only frustrated by the most careful watching; she endeavored to strangle herself with the bed-clothes, to swallow any article she could lay hold of, and even to gouge out her own eyes. Food is generally persistently refused, and the utmost coaxing may fail in inducing the patient to take nourishment. The pulse is rapid and small, and the more violent the excitement and furious the delirium, the more excited is the circulation. The tongue is coated and furred, the bowels constipated and disordered, and the fæces, as well as the urine, are frequently passed involuntarily. The urine is scanty and high-colored, and, after the disease has lasted for some time, it becomes loaded with phosphates. The lochia, and the secretion of milk, generally become arrested at the commencement of the disease. The waste of tissue, from the incessant restlessness and movement of the patient, is very great; and, if the disease continue for some time, she falls into a condition of marasmus, which may be excessive, so that she becomes wasted to a shadow of her former size.

When the insanity assumes the form of melancholia, its advent is more gradual. It may commence with depression of spirits, without any adequate cause, associated with insomnia, disturbed digestion, headache, and other indications of bodily derangement. Such symptoms, showing themselves in women who have been nursing for a length of time, or in whom any other evident cause of exhaustion exists, should never pass unnoticed. Soon the signs of mental depression increase, and positive delusions show themselves. These may vary much in their amount, but they are all more or less of the same type, and very often of a religious character. The amount of constitutional disturbance varies much. In some cases which approach in character those of mania, there is considerable excitement, rapid pulse, furred tongue, and restlessness. Probably cases of acute melancholia, coming on during the puerperal state, most often assume this form. In others, again, there is less of these general symptoms; the patients are profoundly dejected, sit for hours without speaking or moving, but there is not much excitement; and this is the form most generally characterizing the insanity of lactation. In all cases there is a marked disinclination to food. There is also, almost invariably, a disposition to suicide; and it should never be forgotten in melancholic cases that this may develop itself in an instant, and that a moment's carelessness on the part of the attendants may lead to disastrous results.

Treatment.—Bearing in mind what has been said of the essential character of puerperal insanity, it is obvious that the course of treatment must be mainly directed to maintain the strength of the patient, so as to enable her to pass through the disease without fatal exhaustion of the vital powers, while we endeavor, at the same time, to calm the excitement and give rest to the disturbed brain. Any over-active measures—for example, bleeding, blistering the shaven scalp, and the like—are distinctly contra-indicated.

There is a general agreement on the part of alienist physicians that in cases of acute mania the two things most needful are a sufficient quantity of suitable food, and sleep.

With regard to the former, every endeavor should be made to induce the patient to take abundance of nourishment, to remedy the effects of the excessive waste of tissue, and support her strength until the disease abates. Dr. Blandford, who has especially insisted on the importance of this indication, says,[1] "Now, with regard to the food, skilful attendants will coax a patient into taking a large quantity, and we can hardly give too much. Messes of minced meat with potato and greens, diluted with beef-tea, bread and milk, rum and milk, arrowroot, and so on, may be got down. Never give mere liquids so long as you can get down solids. As the malady progresses, the tongue and mouth may become so dry and foul that nothing but liquids can be swallowed; but, reserving our beef-tea and brandy, let us give plenty of solid food while we can."

Forcible Administration of Food.—The patient may in mania, as well as in melancholia, perhaps even more in the latter, obstinately refuse to take nourishment at all, and we may be compelled to use force. Various contrivances have been employed for this purpose. One of the simplest is introducing a dessert-spoon forcibly between the teeth, the patient being controlled by an adequate number of attendants, and slowly injecting into the mouth suitable nourishment, by an india-rubber bottle with an ivory nozzle, such as is sold by all chemists. Care must be taken not to inject more than an ounce at a time, and to allow the patient to breathe between each deglutition. So extreme a measure will seldom be required, if the patient have experienced attendants, who can overcome her resistance to food by gentler means; but it may be essential, and it is far better to employ it than to allow the patient to become exhausted from want of nourishment. In one case I had to feed a patient in this way three times a day for several weeks, and used for the purpose a contrivance known in asylums as Paley's feeding-bottle, which reduced the difficulty of the process to a minimum. Beef-tea, or strong soup, mixed with some farinaceous material, such as Revalenta Arabica, or wheaten flour, or milk, form the best mess for this purpose.

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[1] Blandford, Insanity and its Treatment.

Stimulants.—In the early stages the patient is probably better without stimulants, which seem only to increase the excitement. As the disease progresses, and exhaustion becomes marked, it may be necessary to have recourse to them. In melancholia they seem to be more useful, and may be administered with greater freedom.

The *state of the bowels* requires especial attention. They are almost always disordered, the evacuations being dark, and offensive in odor. In the early stages of the disease, the prompt clearing of the bowels, by a suitable purgative, sometimes has the effect of cutting short an impending attack. A curious example of this is recorded by Gooch, in which the patient's recovery seemed to date from the free evacuation of the bowels. A few grains of calomel, or a dose of compound jalap powder, or of castor-oil, may generally be readily given. During the continuance of the illness the state of the primæ viæ should be attended to, and occasional aperients will be useful; but strong and repeated purgation is hurtful, from the debility it produces.

The *procuring of sleep* will necessarily form one of the most important points of treatment. For this purpose there is no drug so valuable as the hydrate of chloral, either alone, or in combination with bromide of potassium, which has a distinct effect in increasing its hypnotic action. Given in a full dose at bedtime, say 15 grs. to ʒss, it rarely fails in procuring at least some sleep, and in an early stage of acute mania this may be followed by the best effects. It may be necessary to repeat this medication night after night, during the acute stage of the malady. If we cannot induce the patient to swallow the medicine, it may be given in the form of enema.

It is generally admitted that in mania preparations of opium, formerly much relied on in the treatment of the disease, are apt to do more harm than good. Dr. Blandford gives a strong opinion on this point. He says, "In prolonged delirious mania I believe opium never does good, and may do great harm. We shall see the effects of narcotic poisoning if it be pushed, but none that are beneficial. This applies equally to opium given by the mouth and by subcutaneous injection. The latter, as it is more certain and effectual in producing good results, is also more deadly when it acts as a narcotic poison. After the administration of a dose of morphia by the subcutaneous method, the patient will probably at once fall asleep, and we congratulate ourselves that our long-wished-for object is attained. But after half an hour or so the sleep suddenly terminates, and the mania and excitement are worse than before. Here you may possibly think that had the dose been larger, instead of half an hour's sleep you would have obtained one of longer duration, and you may administer more, but with a like result. Large doses of morphia not merely fail to produce refreshing sleep; they poison the patient, and produce, if not the symptoms of actual narcotic poisoning, at any rate that typhoid condition which indicates prostration and approaching collapse. I believe there is no drug the use of which more often becomes abused than that of opium." It is otherwise in cases of melancholia, especially in the more chronic forms. In these, opiates, in moderate doses, not pushed to excess, may be given with great advantage. The subcutaneous injection of morphia is by far the best means of exhibiting the drug, from its rapidity of action and facility of administration.

There are other methods of calming the excitement of the patient besides the use of medicines. The prolonged use of the warm bath, the patient being immersed in water at a temperature of 90° or 92° for at least half an hour, is highly recommended by some as a sedative. The wet pack serves the same purpose, and is more readily applied in refractory subjects.

The *judicious nursing of the patient* is a point of primary importance. She should be kept in a cool, well-ventilated, and somewhat darkened room. If possible, she should remain in bed, or, at least, endeavors should be made to restrain the excessive restless motion, which has so much effect in promoting exhaustion. The presence of relatives and friends, especially the husband, has generally a prejudicial and exciting effect; and it is advisable to place the patient under the care of nurses experienced in the management of the insane, and who, as strangers, are likely to have more control over her. It is not too much to say that much of the success in treatment must depend on the manner in which this indication is met. Rough, unskilled nurses, who do not know how to use gentleness combined with firmness, will certainly aggravate and prolong the disorder. Inasmuch as no patient should be left unwatched by day or night, more than one nurse is essential.

The question of the removal of the patient to an asylum is one which will give rise to anxious consideration. As the fact of having been under such restraint of necessity fixes a certain lasting stigma upon a patient, this is a step which every one would wish to avoid if possible. In cases of acute mania, which will probably last a comparatively short time, home treatment can generally be efficiently carried out. Much must depend on the circumstances of the patient. If these be of a nature which preclude the possibility of her obtaining thoroughly efficient nursing and treatment in her own home, it is advisable to remove her to a place where these essentials can be obtained, even at the cost of some subsequent annoyance. In cases of chronic melancholia, the management of which is on the whole more difficult, the necessity for such a measure is more likely to arise, and should not be postponed too late. Many examples of incurable dementia, arising out of puerperal melancholia, can be traced to unnecessary delay in placing the patients under the most favorable conditions for recovery.

Treatment during Convalescence.—When convalescence is commencing, change of air and scene will often be found of great value. Removal to some quiet country place, where the patient can enjoy abundance of air and exercise, in the company of her nurses, without the excitement of seeing many people, is especially to be recommended. Great caution must be used in admitting the visits of relatives and friends. In two cases under my own care the patients relapsed, when apparently progressing favorably, because the husbands insisted, contrary to advice, on seeing their wives. On the other hand, Gooch has pointed out that, when the patient is not recovering, when month after month has been passed in seclusion without any improvement, the visit of a friend or relative may produce a favorable moral impression and inaugurate a change for the better. It is probably in cases of melancholia, rather than in mania, that this is likely to happen. The experiment may, under such circumstances, be worth trying; but it is one the result of which we must contemplate with some anxiety.

CHAPTER V.

PUERPERAL SEPTICÆMIA.

There is no subject in the whole range of obstetrics which has caused so much discussion and difference of opinion as that to which this chapter is devoted. Under the name of "*Puerperal Fever*," the disease we have to consider has given rise to endless controversy. One writer after another has stated his view of the nature of the affection with dogmatic precision, often on no other grounds than his own preconceived notions, and an erroneous interpretation of some of the post-mortem appearances. Thus, one states that puerperal fever is only a local inflammation, such as peritonitis; others declare it to be phlebitis, metritis, metro-peritonitis, or an essential zymotic disease, *sui generis*, which affects lying-in women only. The result has been a hopeless confusion; and the student rises from the study of the subject with little more useful knowledge than when he began. Fortunately, modern research is beginning to throw a little light upon the chaos.

The whole tendency of recent investigation is daily rendering it more and more certain that obstetricians have been led into error by the special virulence and intensity of the disease, and that they have erroneously considered it to be something special to the puerperal state, instead of recognizing in it a form of septic disease practically identical with that which is familiar to surgeons under the name of pyæmia or septicæmia.

If this view be correct, the term "puerperal fever," conveying the idea of a fever such as typhus or typhoid, must be acknowledged to be in itself misleading, and one that should be discarded, as only tending to confusion. Before discussing at length the reasons which render it probable that this form of disease is in no way specific or peculiar to the puerperal state, it will be well to relate briefly some of the leading facts connected with it.

More or less distinct references to the existence of the so-called puerperal fever are met with in the classical authors, proving, beyond doubt, that the disease was well known to them; and Hippocrates, besides relating several cases the nature of which is unquestionable, clearly recognizes the possibility of its originating in the retention and decomposition of portions of the placenta. Although Harvey and other writers showed that they were more or less familiar with it, and even made most creditable observations on its etiology, it was not until the latter half of the last century that it came prominently into notice. At that time the frightful mortality occurring in some of the principal lying-in hospitals, especially in the Hôtel-Dieu at Paris, attracted attention; and ever since the disease has been familiar to obstetricians.

Its prevalence in hospitals in which lying-in women are congregated has been constantly observed both in this country and abroad, occasionally producing an appalling death-rate; the disease, when once it has appeared, frequently spreading from one patient to another, in spite of all that could be done to arrest it. It would be easy to give many startling instances of this. Thus, it prevailed in London in the years 1760, 1768, and 1770, to such an extent that in some lying-in institutions nearly all the patients died. Of the Edinburgh Infirmary in 1773, it is stated that "almost every woman, as soon as she was delivered, or perhaps about twenty-four hours after, was seized with it, *and all of them died*, though every method was used to cure the disorder." On the Continent, where the lying-in institutions are on a much larger scale, the mortality was equally great. Thus, in the Maison d'Accouchements of Paris, in a number of different years, sometimes as many as 1 in 3 of the women delivered died; on one occasion 10 women dying out of 15 delivered. Similar results were observed in other great Continental hospitals, as in Vienna, where, in 1823, 19 per cent. of the cases died, and, in 1842, 16 per cent.; and in Berlin, in 1862, hardly a single patient escaped, the hospital being eventually closed.

Such facts, the correctness of which is beyond any question, prove to demonstration the great risk which may accompany the aggregation of lying-in women. Whether they justify the conclusion that all lying-in hospitals should be abolished, is another and a very wide question, which can scarcely be satisfactorily discussed in a practical work. It is to be observed, however, that most of the cases in which the disease produced such disastrous results occurred before our more recent knowledge of its mode of propagation was acquired, when no sufficient hygienic precautions were adopted, when ventilation was little thought of, and when, in a word, every condition prevailed that would tend to favor the spread of a contagious disease from one patient to another. More recent experience proves that when the contrary is the case (as, for example, in such an institution as the Rotunda Hospital in Dublin) the occurrence of epidemics of this kind may be entirely prevented, and the mortality approximated to that of home practice.

The more closely the history of these outbreaks in hospitals is studied, the more apparent does it become that they are not dependent on any miasm necessarily produced by the aggregation of puerperal patients, but on the direct conveyance of septic matter from one patient to another.

In numerous instances the disease has been said to be generally epidemic in domiciliary practice, much in the same way as scarlet fever, or any other zymotic complaint, might be. Such epidemics are described as having occurred in London in 1827–28, in Leeds in 1809–12, in Edinburgh in 1825, and many others might be cited. There is, however, no sufficient ground for believing that the disease has ever been epidemic in the strict sense of the word. That numerous cases have often occurred in the same place, and at the same time, is beyond question; but this can easily be explained without admitting an epidemic influence, knowing, as we do, how readily the septic matter may be conveyed from one patient to another. In many of the so-called epidemics the disease has been limited to the patients of certain midwives or practitioners, while those of others have entirely escaped; a fact easily understood on the assumption of the disease being produced by septic matter conveyed to the patient, but irreconcilable with the view of general epidemic influence.

It would be a useless task to detail at length the theories that have been advanced to explain the disease. Indeed, it may safely be held that the supposed necessity of providing a theory which would explain all the facts of the disease has done more to surround it with obscurity than even the difficulties of the subject itself. If any real advance is to be made, it can only be by adopting an humble attitude, by admitting that we are only on the threshold of the enquiry, and by a careful observation of clinical facts, without drawing from them too positive deductions.

Many have taught that the disease is essentially a local inflammation, producing secondary constitutional effects. This view doubtless originated from too exclusive attention to the morbid changes found on post-mortem examination. Extensive peritonitis, phlebitis, inflammation of the lymphatics, or of the tissues of the uterus itself, are very commonly found after death; and each of these has, in its turn, been believed to be the real source of the disease. This view finds but little favor with modern pathologists, and is in so many ways inconsistent with clinical facts that it may be considered to be obsolete. No one of the conditions above mentioned is universally found, and, in the worst cases, definite signs of local inflammation may be entirely absent. Nor will this theory explain the conveyance of the disease from one patient to another, or the peculiar severity of the constitutional symptoms.

A more admissible theory, and one which has been extensively entertained, is that there is an essential zymotic fever peculiar to, and only attacking, puerperal women, which is as specific in its nature as typhus or typhoid, and to which the local phenomena observed after death bear the same relation that the pustules on the skin do to small-pox, or the ulcers in the intestinal glands to typhoid. This fever is supposed to spread by contagion and infection, and to prevail epidemically, both in private and in hospital practice. The most recent exponent of this view is

Fordyce Barker, who, in his excellent work on the "Puerperal Diseases," has entered at length into all the theories of the disease. He, like others who hold his opinions, has, I cannot but think, entirely failed to bring forward any conclusive evidence of the existence of such a specific fever. It is no doubt true that in typhus and typhoid, and other undoubted examples of this class of disease, there are well-marked local secondary phenomena; but then they are distinct and constant. He makes no attempt to prove that anything of the kind occurs in puerperal fever. On the contrary, probably there are no two cases in which similar local phenomena occur; nor is there any case in which the most practised obstetrician could foretell either the course and duration of the illness, or the local phenomena. Again, this theory altogether fails to explain the very important class of cases which can be distinctly traced to sources originating in the patient herself, viz., the absorption of septic matter from decomposing coagula, and the like. Barker meets this difficulty by placing such cases of auto-infection under a separate category, admitting that they are examples of septicæmia. But he fails to show that there is any difference in symptomatology or post-mortem signs between them and the cases he believes to depend on an essential fever; nor would it be possible to distinguish the one from the other by either their clinical or pathological history.

The modern view, which holds that the disease is, in fact, identical with the condition known as pyæmia or septicæmia, is by no means free from objections, and much patient clinical investigation is required to give a satisfactory explanation of certain peculiarities which the disease presents; but, in spite of these difficulties, which time may serve to remove, it offers a far better explanation of the phenomena observed than any other that has yet been advanced.

According to this theory, the so-called puerperal fever is produced by the absorption of septic matter into the system, through solutions of continuity in the generative tract, such as always exist after labor. It is not essential that the poison should be peculiar or specific; for, just as in surgical pyæmia, any decomposing organic matter, either originating within the generative organs of the patient herself, or coming from without, may set up the morbid action.

In describing the disease under discussion, I shall assume that, so far as our present knowledge goes, this view is the one most consonant with facts; but, bearing in mind that very little is yet known of surgical septicæmia, it must not be expected that obstetricians can satisfactorily explain all the phenomena they observe.

The best basis of description I know of is that given by Burdon Sanderson, when he says, "in every pyæmic process you may trace a focus, a centre of origin, lines of diffusion or distribution, and secondary results from the distribution; in every case an initial process from which infection commences, from which the infection spreads, and secondary processes which come out of this primary one."[1] Adopting this division, I shall first treat of the mode in which the infection may commence in obstetric cases, and point out the special difficulties which this part of the subject presents.

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[1] Clinical Transactions, vol. viii. p. cviii.

The fact that all recently delivered women present lesions of continuity in the generative tract, through which septic matter, brought into contact with them, may be readily absorbed, has long been recognized by obstetricians. The analogy between the interior of the uterus and the surface of a stump after operation was particularly insisted on by Cruveilhier, Simpson, and others; an analogy which was to a great extent based on erroneous conceptions of what took place, since they conceived that the whole interior of the uterus was bared after delivery. It is now well known that that is not the case; but the fact remains that at the placental site, at any rate, there are open vessels through which absorption may readily take place. That absorption of septic material occurs through this channel is probable in certain cases in which decomposing materials exist in the interior of the uterus, especially when, from defective uterine contraction, the venous sinuses are abnormally patulous, and are not occluded by thrombi. It is difficult to understand how septic matter, introduced from without, can reach the placental site. Other sites of absorption are, however, always available. These exist in every case, in the form of slight abrasions or lacerations about the cervix, or in the vagina, or, especially in primiparæ, about the fourchette and perinæum, which rarely escape intact. There is even some reason to think that absorption of septic matter may take place through the mucous membrane of the vagina or cervix without any breach of surface. This might serve to account for the occasional, although rare, cases in which symptoms of the disease develop themselves before delivery, or so soon after it as to show that the infection must have preceded labor; nor is there any inherent improbability in the supposition that septic material may be occasionally absorbed through the unbroken mucous membrane, as is certainly the case with some poisons, for example that of syphilis. Hence there is no difficulty in recognizing the similarity of a lying-in woman to a patient suffering from a recent surgical lesion, or in understanding how septic matter conveyed to her during or shortly after labor may be absorbed. It is necessary, however, to suppose that absorption takes place immediately or very shortly after these lesions of continuity are formed, for it is well known that the power of absorption is arrested after they have commenced to heal. This fact may explain the cases in which sloughing about the perinæum or vagina exists without any septicæmia resulting, or the far from uncommon cases in which an intensely fetid lochial discharge may be present a few days after delivery, without any infection taking place.

The character and sources of the septic matter constitute one of the most obscure questions in connection with septicæmia, and that which is most open to discussion.

The most practical division of the subject is into cases in which the septic matter originates within the patient, so that she infects herself, the disease then being properly *autogenetic;* and into those in which the septic matter is conveyed from without, and brought into contact with absorptive surfaces in the generative tract, the disease then being *heterogenetic.*

The *sources of auto-infection* may be various, but they are not difficult to understand. Any condition giving rise to decomposition, either of the tissues of the mother herself, of matters retained in the uterus or vagina that ought to have been expelled, or decomposing matter derived from a putrid fœtus, may start the septicæmic process. Thus, it may happen that, from continuous pressure on the maternal soft parts during labor, sloughing has set in; or there may be already decomposing material present from some previous morbid state of the genital tracts, as in carcinoma. A more common origin is the retention of coagula, or of small portions of membrane, or of placenta, in the interior of the uterus, which have putrefied from the access of air through the vagina; or in the decomposition of the lochia. The reason why self-infection does not more often occur from such sources, since more or less decomposition is of necessity so often present, has already been referred to in the fact that absorption of such matters is not apt to occur when the lesions of continuity, always existing after parturition, have commenced to heal. This observation may also serve to explain how previous bad states of health, by interfering with the healthy reparative processes occurring after delivery, may predispose to self-infection. It is interesting to note that puerperal septicæmia, arising from such sources, is not limited to the human race. In the debate on pyæmia at the Clinical Society Mr. Hutchinson records several well-marked examples occurring in ewes, in whose uteri portions of retained placenta were found.

The sources of septic matter conveyed from without are much more difficult to trace, and there are many facts connected with heterogenetic infection which are very difficult to reconcile with theory, and of which, it must be admitted, we are not yet able to give a satisfactory explanation. It is probable that any decomposing organic matter may infect, but that some forms operate with more certainty and greater virulence than others.

One of these, which has attracted special attention, is what may be termed cadaveric poison, derived from dissection of the dead subject in the anatomical and post-mortem theatre, and conveyed to the genital tract by the hands of the accoucheur. Attention was particularly directed to this source of infection by the observations of Semmelweiss, who showed that in the division of the Vienna Lying-in Hospital attended by medical men and students who frequented the dissecting-rooms, the mortality was seldom less than 1 in 10, while in the division solely attended by women, the mortality never exceeded 1 in 34; the number of deaths in the former division at once falling to that of the latter as soon as proper precautions and means of disinfection were used. Many other facts of a like nature have since been recorded, which render this origin of puerperal septicæmia a matter of certainty. An interesting example is related by Simpson with characteristic candor:—"In 1836 or 1837, Mr. Sidey of this city had a rapid succession of five or six fatal cases of puerperal fever in his practice, at a time when the disease was not known to exist in the practice of any other practitioners in the locality. Dr. Simpson, who had then no firm or proper belief in the contagious propagation of puerperal fever, attended the dissection of two of Mr. Sidey's patients, and freely handled the diseased parts. The next four cases of midwifery which Dr. Simpson attended were all affected with puerperal fever, and it was the first time he had seen it in practice. Dr. Patterson of Leith examined the ovaries, &c. The three next cases which Dr. Patterson attended in that town were attacked with the disease."[1] Negative examples are of course brought forward of those who have attended post-mortem examinations without injury to their obstetric patients, which merely prove that the cadaveric poison does not of necessity attach itself to the hands of the dissector; and no amount of such testimony can invalidate such positive evidence as that just narrated. Barnes believes that there is not so much danger in attending the dissection of patients who have died of any ordinary disease, but that the risk attending the dissection of those who have died of infectious or contagious complaints is very great indeed.[2] I presume there is no doubt that the risk is greater when the subject has died from zymotic disease; but the distinction is too delicate to rely on, and the attendant on midwifery will certainly err on the safe side by avoiding, as much as possible, having anything to do with the conduct of dissections or post-mortem examinations.

Infection from Erysipelas.—Another possible source of infection is erysipelatous disease in all its forms. The intimate connection between erysipelas and surgical pyæmia has long been recognized by surgeons, and the influence of erysipelas in producing puerperal septicæmia has been especially observed in surgical hospitals in which lying-in patients were also admitted. Trousseau relates instances of this kind occurring in Paris. The only instance that I know of in London was in the lying-in ward of King's College Hospital, where, in spite of every hygienic precaution, the mortality was so great as to necessitate the closure of the ward. Here the association of erysipelas with puerperal septicæmia was again and again observed; the latter proving fatal in direct proportion to the prevalence of the former in the surgical wards. The dependence of the two on the same poison was in one instance curiously shown by the fact of the child of a patient who died of puerperal septicæmia, dying from erysipelas which started from a slight abrasion produced by the forceps. But the connection between erysipelas and puerperal septicæmia is not limited to hospitals, having been often observed in domiciliary practice. Some interesting facts have been collected by Dr. Minor,[3] who has shown that the two diseases have frequently prevailed together in various parts of the United States, and that during a recent outbreak of puerperal fever in Cincinnati it occurred chiefly in the practice of those physicians who attended cases of erysipelas. Many children also died from erysipelas, whose mothers had died from puerperal fever.

Infection from other Zymotic Diseases.—There is good reason to believe that the contagium of other zymotic diseases may produce a form of disease indistinguishable from ordinary puerperal septicæmia, and presenting none of the characteristic features of the specific complaint from which the contagium was derived. This is admitted to be a fact by the majority of our most eminent British obstetricians, although it does not seem to be allowed by Continental authorities, and it is strongly controverted by some writers in this country. It is certainly difficult to reconcile this with the theory of septicæmia, and we are not in a position to give a satisfactory explanation of it. I believe, however, that the evidence in favor of the possibility of puerperal septicæmia originating in this way is too strong to be assailable.

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[1] Selected Obstet. Works, p. 508.

[2] "Lectures on Puerperal Fever," Lancet, vol. ii., 1865.

[3] Erysipelas and Childbed Fever, Cincinnati, 1874.

The scarlatinal poison is that regarding which the greatest number of observations have been made. Numerous cases of this kind are to be found scattered through our obstetric literature; but the largest number are to be met with in a paper by Dr. Braxton Hicks, in the 12th volume of the "Obstetrical Transactions," and they are especially valuable from that gentleman's well-known accuracy as a clinical observer. Out of 68 cases of puerperal disease seen in consultation, no less than 37 were distinctly traced to the scarlatinal poison. Of these, 20 had the characteristic rash of the disease; but the remaining 17, although the history clearly proved exposure to the contagium of scarlet fever, showed none of its usual symptoms, and were not to be distinguished from ordinary typical cases of the so-called puerperal fever. On the theory that it is impossible for the specific contagious diseases to be modified by the puerperal state, we have to admit that one physician met with 17 cases of puerperal septicæmia in which, by a mere coincidence, the contagium of scarlet fever had been traced, and that the disease nevertheless originated from some other source—an hypothesis so improbable that its mere mention carries its own refutation.

With regard to the other zymotic diseases the evidence is not so strong; probably from the comparative rarity of the diseases. Hicks mentions one case in which the diphtheritic poison was traced, although none of the usual phenomena of the disease were present. I lately saw a case in which a lady, a few days after delivery, had a very serious attack of septicæmia, without any diphtheritic symptoms, her husband being at the same time attacked with diphtheria of a most marked type. Here it would be difficult not to admit the dependence of the two diseases on the same poison.

It is, however, certain that all the zymotic diseases may attack a newly-delivered woman, and run their characteristic course without any peculiar intensity. Probably most practitioners have seen cases of this kind; and this is precisely one of the points of difficulty which we cannot at present explain, but on which future research may be expected to throw some light. It seems to me not improbable that the explanation of the fact that zymotic poison may in one puerperal patient run its ordinary course, and in another produce symptoms of intense septicæmia, may be found in the channel of absorption. It is at any rate comprehensible that if the contagium be absorbed through the skin or the ordinary channels, it may produce its characteristic symptoms and run its usual course; while if brought into contact with lesions of continuity in the generative tract, it may act more in the way of septic poison, or with such intensity that its specific symptoms are not developed.

It may reasonably be objected that if puerperal and surgical septicæmia be identical, the zymotic poisons ought to be similarly modified when they infect patients after surgical operations. The subject of specific contagium as a cause of surgical pyæmia has been so little studied that I do not think any one would be justified in asserting that such an occurrence is not possible.[1] Mr. Spencer Wells informs me that he has seen cases of surgical pyæmia which he had reason to believe originated in the scarlatinal poison; and his well-known success as an ovariotomist is, no doubt, in a great measure to be attributed to his extreme care in seeing that no one likely to come in contact with his patients has been exposed to any such source of infection.

The last source from which septic matter may be conveyed is from a patient suffering from puerperal septicæmia, a mode of origin which has of late attracted special attention. That this is the explanation of the occasional endemic prevalence of the disease in lying-in hospitals can scarcely be doubted. The theory of a special puerperal miasm pervading the hospital is not required to account for the facts, for there are a hundred ways, impossible to detect or avoid—on the hands of nurses, or attendants, in sponges, bed-pans, sheets, or even suspended in the atmosphere—in which septic material derived from one patient may be carried to another.

That the poison may be conveyed, in the same manner, from one private patient to another is also beyond any doubt. Of this there are many lamentable instances recorded. Thus, it was mentioned by a gentleman at the recent discussion at the Obstetrical Society, that 5 out of 14 cases he attended died, no other practitioner in the neighborhood having a case. This origin of the disease was clearly pointed out by Gordon[2] towards the end of the last century, who states that he himself "was the means of carrying the infection to a great number of women," and he also traced the disease in the same way in the practice of certain midwives. In some remarkable instances the unhappy property of carrying contagion has clung to individuals in a way which is most mysterious, and which has led to the supposition that the whole system becomes saturated with the poison. One of the strangest cases of this kind was that of Dr. Rutter, of Philadelphia, which caused much discussion. He had 45 cases of puerperal septicæmia in his own practice in one year, while none of his neighbors' patients were attacked. Of him it is related, "Dr. Rutter, to rid himself of the mysterious influence which seemed to attend upon his practice, left the city for ten days, and before waiting on the next parturient case had his hair shaved off, and put on a wig, took a hot bath, and changed every article of his apparel, taking nothing with him that he had worn or carried, to his knowledge, on any former occasion: and mark the result. The lady, notwithstanding that she had an easy parturition, was seized the next day with childbed fever, and died on the eleventh day after the birth of the child. Two years later, he made another attempt at self-purification, and the next case attended fell a victim to the same disease." No wonder that Meigs, in commenting on such a history, refused to believe that the doctor carried the poison, and rather thought that he was "merely unhappy in meeting with such accidents through God's providence." It appears, however, that Dr. Rutter was the subject of a form of ozæna; and it is quite obvious that, under such circumstances, his hands could never have been free from septic matter.[1] This observation is of peculiar interest, as showing that the sources of infection may exist in conditions difficult to suspect and impossible to obviate, and it affords a satisfactory explanation of a case which was for years considered puzzling in the extreme. It is quite possible that other similar cases, of which many are on record, although none so remarkable, may possibly have depended on some similar cause personal to the medical attendant.

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[1] Since the above was written, I have seen a paper by Sir James Paget, in his recently published Clinical Lectures, which seems to point to the possibility of such modification. He says, "I think it not improbable that, in some cases, results occurring with obscure symptoms, within two or three days after operations, have been due to the scarlet-fever poison, hindered in some way from its usual progress."

[2] See Lectures on Puerperal Fever, by Robert J. Lee, M.D.

The sources of septic poison being thus multifarious, a few words may be said as to the mode in which it may be conveyed to the patient. As on the view of puerperal septicæmia which seems most to agree with recorded facts, the poison, from whatever source it may be derived, must come into actual contact with lesions of continuity in the generative tract, it is obvious that one method of conveyance may be on the hands of the accoucheur. That this is a possibility, and that the disease has often been unhappily conveyed in this way, no one can doubt. Still, it would be unfair in the extreme to conclude that this is the only way in which infection may arise. In town practice, especially, there are many other ways in which septic matter may reach the patient. The nurse may be the means of communication, and, if she have been in contact with septic matter, she is even more likely than the medical attendant to convey it when washing the genitals during the first few days after delivery, the time that absorption is most apt to occur. Barnes relates a whole series of cases occurring in a suburb of London, in the practice of different practitioners, every one of which was attended by the same nurse. Again, it is very probable that septic matter may be carried in sponges, linen, and other articles. What is more likely, for example, than that a careless nurse might use an imperfectly washed sponge, on which discharge has been allowed to remain and decompose? Nor do I see any reason to question the possibility of infection from septic matter suspended in the atmosphere; and in lying-in hospitals, where many women are congregated together, there can be little doubt that this is a common origin of the disease. It is certain, whatever view we may take of the character of the septic material, that it must be in a state of very minute subdivision, and there is no theoretical difficulty in the assumption of its being conveyed by the atmosphere.

This question naturally involves a reference to the duty of those who are unfortunately brought into contact with septic matter in any form, either in a patient suffering from puerperal septicæmia, zymotic disease, or offensive discharges. The practitioner cannot always avoid such contact, and it is practically impossible, as Dr. Duncan has insisted, to relinquish obstetric work every time that he is in attendance on a case from which contagion may be carried. Nor do I believe, especially in these days, when the use of antiseptics is so well understood, that it is essential. It was otherwise when antiseptics were not employed; but I can scarcely conceive any case in which the risk of infection cannot be prevented by proper care. The danger I believe to be chiefly in not recognizing the possible risk, and in neglecting the use of proper precautions. It is impossible, therefore, to urge too strongly the necessity of extreme and even exaggerated care in this direction. The practitioner should accustom himself as much as possible to use the left hand only in touching patients suffering from infectious diseases, as that which is not used, under ordinary circumstances, in obstetric manipulations. He should be most careful in the frequent employment of antiseptics in washing his hands, such as Condy's fluid, carbolic acid, or tincture of iodine. Clothing should be changed on leaving an infectious case. Much more care than is usually practised should be taken by nurses, especially in securing perfect cleanliness in everything brought into contact with the patient. When, however, a practitioner is in actual and constant attendance on a case of puerperal septicæmia, when he is visiting his patient many times a day, especially if he be himself washing out the uterus with antiseptic lotions, as it is frequently advisable for him to do, it is certain that he cannot deliver other patients with safety, and he should secure the assistance of a brother practitioner; although there seems no reason why he should not visit women already confined, in whom he has not to make vaginal examinations.

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[1] This is stated on the authority of an obstetrical contemporary of Dr. Rutter. See Amer. Journ. of Med. Sciences, April, 1875, p. 474.

Nature of the Septic Poison.—As to the precise character of the septic poison—although of late much has been said about it, and there is good reason to believe that further research may throw light on this obscure subject—too little is known to justify any positive statement. With regard to the influence of the minute organisms known as bacteria, and their supposed connection with the production of the disease, this is especially the case. Heiberg has proved that they may be traced, in most cases of puerperal septicæmia, passing through the veins and lymphatics, and that they are found in various organs and pathological products. But what their relation is to the disease, whether they themselves form the septic matter, or carry it, or whether they are mere accidental concomitants of the pyæmic process, it is impossible, in the present state of our knowledge, to state; and I therefore prefer to dwell on that part of the subject which is clinically of importance, rather than enter into speculative theories, which may to-morrow prove to be valueless.

Channels of Diffusion.—Passing on to the channels of diffusion through which the septic matter may act, we have to consider its effects on the structures with which it is brought into contact, and the mode in which it may infect the system at large; and this will include a consideration of the pathological phenomena.

Local changes consequent on the absorption of the poison are pretty constant, and of these we may form an intelligible idea by thinking of them as similar in character and causation to those which we have the opportunity of studying when septic matter is applied to a wound open to observation, as, for example, in cases of blood-poisoning following a dissection wound. Distinct traces of local action are not of invariable occurrence, and in some of the worst class of cases, when the amount of septic matter is great, and its absorption rapid, death may occur after an illness of short duration but great intensity, and before appreciable local changes, either at the site of absorption or in the system at large, have had time to develop themselves. The fact that puerperal fever may prove fatal, without leaving any tangible post-mortem signs, has often been pointed out, such cases most frequently occurring during the endemic prevalence of the disease in lying-in hospitals. There can be little doubt, however, that in such cases of intense septicæmia marked pathological changes exist, in the form of alterations of the blood and degenerations of tissue, but not of a character which can be detected by an ordinary post-mortem examination. In the great majority of cases, indications of the disease exist at the sites of absorption. These are described by pathologists as identical in their character with the inflammatory œdema which occurs in connection with phlegmonous erysipelas. If lacerations exist in the cervix or vagina, they take on unhealthy action, their edges swell, and their surfaces become covered with a yellowish coat, similar in appearance to diphtheritic membrane. The mucous membrane of the uterus is also generally found to be affected, and in a degree varying with the intensity of the local septic process. There is evidence of severe endometritis; and very frequently the whole lining of the uterus is profoundly altered, softened, covered with patches of diphtheritic deposit, and it may be in a state of general necrosis. In the severer cases these changes affect the muscular tissue of the uterus, which is found to be swollen, soft, imperfectly contracted, and even partially necrosed, a condition which is likened by Heiberg to hospital gangrene. The connective tissue surrounding the generative tract is also swollen and œdematous, and the inflammation may in this way reach the peritoneum, although peritonitis, so often observed in puerperal septicæmia, does not necessarily depend on the direct transmission of inflammation from the pelvic connective tissue, but is more often a secondary phenomenon.

The channels through which general systemic infection may supervene are the lymphatics and the venous sinuses, the former being by far the most important. Recent researches have shown the great number and complexity of the lymphatics in connection with the pelvic viscera, and marked traces of the absorption of septic matter are almost always to be found, except in those very intense cases already alluded to, in which no appreciable post-mortem signs are discoverable. The septic matter is probably absorbed from the lymph-spaces abounding in the connective tissue, and carried along the lymphatic canals to the nearest glands. The result is inflammation of their coats, and thrombosis of their contents, which may be seen on section as a creamy purulent substance. The absorption of septic material may, as Virchow has shown, be delayed by the local changes produced in the lymphatics and in the glands with which they communicate, which are, therefore, conservative in their action; and the farther progress of the case may in this way be stopped, and local inflammation alone result, such cases being believed by Heiberg to be examples of abortive pyæmia. On the other hand, the free septic material may be too abundant and intense to be so arrested, it may pass on through the lymph canals and glands, until it reaches the blood-current through the thoracic duct, and so produces a general blood-infection. This mode of absorption of septic matter, and the tendency of the glands to arrest its further progress, serve to explain the progressive character of many cases, in which fresh exacerbations seem to occur from time to time; since fresh quantities of poison, generated at its source of origin, may be absorbed as the case progresses. The uterine veins are supposed by D'Espinne to be the channel of absorption in the intense form of disease which proves fatal very shortly after delivery, too soon for the more gradual process of lymphatic absorption to have become established. It is evident that the veins are not likely to act in this way, since they must, under ordinary circumstances, be completely occluded by thrombi, otherwise hemorrhage would occur. If, however, uterine contraction be incomplete, the occlusion of the venous sinuses may be imperfect, and absorption of septic material through them may then take place. Some writers have laid great stress on imperfect uterine contraction in predisposing to septicæmia, and its influence may thus be well explained. The veins may bear an important part in the production of septicæmia, independent of the direct absorption of septic matter through them, by means of the detachment of minute portions of their occluding thrombi, in the form of emboli. If phlegmonous inflammation occur in the immediate vicinity of the veins, the thrombi they contain may become infected. When once blood-infection has occurred, by any of these channels, general septicæmia, the so-called puerperal fever, is developed.

The variety of pathological phenomena found on post-mortem examination has had much to do with the prevalent confusion as to the nature of the disease. This has resulted in the description of many distinct forms of puerperal fever; the most marked pathological alteration having been taken to be the essential element of the disease. As a matter of fact, there is no doubt that various types of pathological change are met with. Heiberg describes four chief classes which are by no means distinctly separated from one another, are often found simultaneously in the same subject, and are certainly not to be distinguished by the symptoms during life.

Of these, the first is the class of cases in which no appreciable morbid phenomena are found after death. This formidable and fatal form of the disease has long been well known, and is that described by some of our authors as adynamic or malignant puerperal fever. It is the variety which was so prevalent in our lying-in hospitals, and which Ramsbotham talks of as being second only to cholera in the severity and suddenness of its onset, and in the rapidity with which it carried off its victims. It is quite erroneous to suppose that the existence of pathological changes in this form of disease has never been recognized. Even with the coarse methods of examination formerly used, the occurrence of a fluid and altered state of the blood, and ecchymoses in connection with various organs—especially the lungs, spleen, and kidneys—were noticed and specially described by Copland in his "Dictionary of Medicine." More recently it has been clearly proved by the microscope that there exist, in addition, the commencement of inflammation in most of the tissues, as shown by cloudy swellings, and granular infiltration and disintegration of the cell-elements; proving that the blood, heavily charged with septic matter, had set up morbid action wherever it circulated, the patient succumbing before this had time to develop.

In the second type, and that perhaps most commonly met with, the morbid changes are most frequently found in the serous membranes, in the pleura, the pericardium, but, above all, in the peritoneum, the alterations in which have long attracted notice, and have been taken by many writers as proving peritonitis to be the main element of the disease. Evidences of more or less peritonitis are very general. In the more severe cases there is little or no exudation of plastic lymph, such as is found in peritonitis unassociated with septicæmia. There is a greater or less quantity of brownish serum only, the coils of intestine, distended with flatus, and highly congested, being surrounded by it. More often there are patchy deposits of fibrinous exudation over many of the viscera, the fundus uteri, the under surface of the liver, and the distended intestines. There is then also a considerable quantity of sero-purulent fluid in the abdominal cavity. The pleural cavities may also exhibit similar traces of inflammatory action, containing imperfectly organized lymph, and sero-purulent fluid. Schroeder states that pleurisy is more often the direct result of transmission of inflammation through the substance of the diaphragm or lung, than a secondary consequence of the septicæmia. In like manner evidences of pericarditis may exist, the surface of the pericardium being highly injected, and its cavity containing serous fluid. Inflammation of the synovial membranes of the larger joints, occasionally ending in suppuration, is not uncommon, and may probably be best included under this class of cases.

In the third type the mucous membranes appear to bear the brunt of the disease. The pathological changes are most marked in the mucous membranes lining the intestines, which is highly congested and even ulcerated in patches, with numerous small spots of blood extravasated in the sub-mucous tissue. Similar small apoplectic effusions have been observed in the substance of the kidneys, and under the mucous membrane of the bladder. Pneumonia is of common occurrence. In most cases it is probably secondary to the impaction of minute emboli in the smaller branches of the pulmonary artery; but it may doubtless arise from independent inflammation of the lung-tissue, and will then be included in the class of cases now under consideration.

The fourth class of pathological phenomena are those which are produced chiefly by the impaction of minute infected emboli in small vessels in various parts of the body. These are the cases which most closely resemble surgical pyæmia, both in their symptoms and post-mortem signs, and which by many writers are described under the name of puerperal pyæmia. The dependence of puerperal fever on phlebitis of the uterine veins was a favorite theory, and in a large proportion of cases the coats of the veins show signs of inflammation, their canals being occupied with thrombi in a more or less advanced state of disintegration. The mode in which these thrombi may become infected has been shown by Babnoff, who has proved that leucocytes may penetrate the coats of the vein, and, entering its contained coagulum, may set up disintegration and suppuration. This observation brings these pyæmic forms of disease into close relation with septicæmia, such as we have been studying, and justifies the conclusion of Verneuil that purulent infection is not a distinct disease, but only a termination of septicæmia, with which it ought to be studied. We have, moreover, to differentiate these results of embolism from those considered in a subsequent chapter; the characteristic of these cases being the infected nature of the minute emboli. Localized inflammations and abscesses, from the impaction of minute capillary emboli, are found in many parts of the body; most frequently in the lungs, then in the kidneys, spleen, and liver, and also in the muscles and connective tissues. Pathologists are by no means agreed as to the invariable dependence of these on embolism, nor is it possible to prove their origin from this source by post-mortem examination. Some attribute all such cases to embolism, others think that they may be the results of primary septicæmic inflammation. It has been proved by Weber that minute infected emboli may pass through the lung capillaries; and this disposes of one argument against the embolic theory, based on the supposed impossibility of their passage. It is probable that both causes may operate, and that localized inflammations occurring a short time after delivery are directly produced by the infected blood, while those occurring after the lapse of some time, as in the second or third week, depend upon embolism.

Description of the Disease.—From what has been said as to the mode of infection in puerperal septicæmia, and as to the very various pathological changes which accompany it, it will not be a matter of surprise to find that the symptoms are also very various in different cases. This can readily be explained by the amount and virulence of the poison absorbed, the channels of infection, and the organs which are chiefly implicated; but it renders it very difficult to describe the disease satisfactorily.

The symptoms generally show themselves within two or three days after delivery. As infection most often occurs during labor, or, in cases which are autogenetic, within a short time afterwards, and before the lesions of continuity in the generative tract have commenced to cicatrize, it can be understood why septicæmia rarely commences later than the fourth or fifth day.

In the great majority of cases the disease begins insidiously. There are, generally, some chilliness and rigor, but by no means always, and even when present they frequently escape observation, or are referred to some transient cause. The first symptom which excites attention is a rise in the pulse, which may vary from 100 to 140 or more, according to the severity of the attack; and the thermometer will also show that the temperature is raised to 102°, or, in bad cases, even to 104° or 106°. Still, it must be borne in mind that both the pulse and temperature may be increased in the puerperal state from transient causes, and do not, of themselves, justify the diagnosis of septicæmia.

Symptoms of Intense Septicæmia.—In the more intense class of cases, in which the whole system seems overwhelmed with the severity of the attack, the disease progresses with great rapidity, and often without any appreciable indication of local complication. The pulse is very rapid, small, and feeble, varying from 120° to 140°, and there is generally a temperature of 103° or 104°. There may be little or no pain, or there may be slight tenderness on pressure over the abdomen or uterus; and, as the disease progresses, the intestines get largely distended with flatus, so that intense tympanites often forms a most distressing symptom. The countenance is sallow, sunken, and has a very anxious expression. As a rule, intelligence is unimpaired, and this may be the case even in the worst forms of the disease, and up to the period of death. At other times, there is a good deal of low muttering delirium, which often occurs at night alone, and alternates with intervals of complete consciousness, but is occasionally intensified, for a short time, into a more acute form. Diarrhœa and vomiting are of very frequent occurrence; by the latter dark, grumous, coffee-ground substances are ejected. The diarrhœa is occasionally very profuse and uncontrollable; in milder cases it seems to relieve the severity of the symptoms. The tongue is moist and loaded with sordes; but sometimes it gets dark and dry, especially towards the termination of the disease. The lochia are generally suppressed, or altered in character, and sometimes they have a highly-offensive odor, especially when the disease is autogenetic. The breathing is hurried and panting, and the breath itself has a very characteristic, heavy, sweetish odor. The secretion of milk is often, but not always, arrested.

Duration of the Disease.—With more or less of these symptoms the case goes on; and when it ends fatally it generally does so within a week, the fatal termination being indicated by more weakness, rapid, threadlike, or intermittent pulse, marked delirium, great tympanites, and sometimes a sudden fall of temperature, until at last the patient sinks with all the symptoms of profound exhaustion.

In milder cases similar symptoms, variously modified and combined, are present. It is seldom that two precisely similar cases are met with: in some, the rapid, weak pulse is most marked; in others, abdominal distension, vomiting, diarrhœa, or delirium.

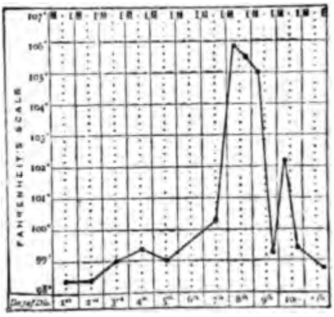
Symptoms of Peritonitis.—Local complications variously modify the symptoms and course of the disease. The most common is peritonitis, so much so that with some authors puerperal fever and puerperal peritonitis are synonymous terms. Here the first symptom is severe abdominal pain, commencing at the lower part of the abdomen, where the uterus is felt enlarged and tender. As the abdominal pain and tenderness spread, the sufferings of the patient greatly increase, the intestines become enormously distended with flatus, and the breathing is entirely thoracic, in consequence of the upward displacement of the diaphragm, and the fact that the abdominal muscles are instinctively kept as much in repose as possible. The patient lies on her back, with her knees drawn up, and sometimes cannot bear the slightest pressure of the bedclothes. There is generally much vomiting, and often severe diarrhœa. The temperature generally ranges from 102° to 104°, or even 106°, and is subject to occasional exacerbations and remissions, possibly depending on fresh absorption of septic matter. The case generally lasts for a week or more, the symptoms going on from bad to worse, and the patient dying exhausted. D'Espinne points out that rigors, with exacerbations of the general symptoms, not unfrequently occur about the sixth or seventh day, which he attributes to fresh systemic infection, from fetid pus in the peritoneal cavity. It must not be supposed that all these symptoms are necessarily present when the peritonic complication exists. Pain especially is often entirely absent, and I have seen cases in which post-mortem examination proved the existence of peritonitis in a very marked degree, in which pain was entirely absent. Sometimes the pain is only slight, and amounts to little more than tenderness over the uterus.

Other local complications are characterized by their own special symptoms: thus, pneumonia by dyspnœa, cough, dulness, &c.; pericarditis, by the characteristic rub; pleurisy, by dulness on percussion; kidney affection, by albuminuria and the presence of casts; liver complication, by jaundice; and so on.

Pyœmic Forms of the Disease.—The course of the disease is not always so intense and rapid, being, in some cases, of a more chronic character. The symptoms in the early stage are often indistinguishable from those already described; and it is generally only after the second week that indications of purulent infection develop themselves. Then we often have recurrent and very severe rigors, with marked elevations and remissions of temperature. At the same time there is generally an exacerbation of the general symptoms, a peculiar yellowish discoloration of the skin, and occasionally well-developed jaundice, while transient patches of erythema are not uncommonly observed on various parts of the skin. Localized inflammations and suppuration may rapidly follow. Amongst the most common is suppuration of the joints—the knees, shoulders, or hips—which is preceded by difficulty of movement, swelling, and very acute pain. Large collections of pus in various parts of the muscles and connective tissues are not rare. Suppurative inflammation may also be found in connection with many organs, as in the eye, in the pleura, pericardium, or lungs; each of which will, of course, give rise to characteristic symptoms, more or less modified by the type of the disease and the intensity of the inflammation.

Treatment.—In considering the all-important subject of treatment, the views of the practitioner are naturally biassed by the theory he has adopted of the nature of the disease. If that here inculcated be correct, the indications we have to bear in mind are: 1st, to discover, if possible, the source of the poison, in the hope of arresting further septic absorption; 2d, to keep the patient alive until the effects of the poison are worn off; and 3d, to treat any local complications that may arise.

The first is likely to be of great importance in cases of self-infection in which the source of mischief still exists, from which fresh quantities of septic matter may be, from time to time, absorbed. We, fortunately, are in possession of a powerful means of fulfilling this indication by the application of antiseptics to the interior of the uterus and to the canal of the vagina. This is especially valuable when the existence of decomposing coagula, or other source of septic matter, is suspected in the uterine cavity, or when offensive discharges are present. Disinfection is readily accomplished by washing out the uterine cavity once or twice a day, by means of a Higginson's syringe with a long vaginal pipe attached. The results are sometimes very remarkable, the threatening symptoms rapidly disappearing, and the temperature and pulse falling so soon after the use of the antiseptic injections as to leave no doubt of the beneficial effects of the treatment. I cannot better illustrate the advantages of this treatment than by the accompanying temperature chart, which is from a case which recently came under my observation in the out-door practice of King's College Hospital. It was that of a healthy woman, thirty-six years of age, who had an easy and natural labor. Nothing remarkable was observed until the third day after delivery, when the temperature was found to be slightly increased. On the morning of the eighth day the temperature had risen to 105.4°. She was delirious, with a rapid, thready pulse, clammy perspiration, tympanitic abdomen, and her general condition indicated the most urgent danger. On vaginal examination a piece of compressed and putrid placenta was found in the os. This was removed by my colleague, Dr. Hayes, and the uterus thoroughly washed out with Condy's fluid and water. The same evening the temperature had sunk to 99°, and the general symptoms were much improved. The next day there was a slight return of offensive discharge, and an aggravation of the symptoms. After again washing out the uterus the temperature fell; and from that date the patient convalesced without a single bad symptom.



This is a very well-marked example of the value of local antiseptic treatment, and I have seen many cases of the same kind. It should, therefore, never be omitted in all cases in which self-infection is possible; and, indeed, even when there is no reason to suspect the presence of a local focus of infection, the use of antiseptic lotions is advisable, as a matter of precaution, since it can do no harm, and is generally comforting to the patient. Any antiseptic may be used, such as a weak solution of carbolic acid, or of tincture of iodine. There is none, however, which answers better than Condy's fluid largely diluted. The nozzle of the syringe should be guided well through the cervix, and the cavity of the uterus thoroughly washed out, until the fluid that issues from the vagina is no longer discolored. As the os is always patulous, there is no risk of producing the troublesome symptoms of uterine colic which occasionally follow the use of intra-uterine injections in the unimpregnated state. It is quite useless to entrust the injection to the nurse, and it should be performed at least twice daily by the practitioner himself, in all cases in which the discharges are offensive.

Administration of Food and Stimulants.—In a disease characterized by so marked a tendency to prostration, the importance of sustaining the vital powers by an abundance of easily assimilated nourishment cannot be overrated. Strong beef-tea, or other form of animal soup, milk, alone or mixed either with lime- or soda-water, and the yolk of eggs, beaten up with milk and brandy, should be given at short intervals, and in as large quantities as the patient can be induced to take; and the value of thoroughly efficient nursing will be specially apparent in the management of this important part of the treatment. As there is frequently a tendency to nausea, the patient may resist the administration of food, and the resources of the practitioner will be taxed in administering it in such form and variety as will prove least distasteful. Generally speaking, not more than one or two hours should be allowed to elapse without some nutriment being given. The amount of stimulant required will vary with the intensity of the symptoms, and the indications of debility. Generally, stimulants are well borne, prove decidedly beneficial, and require to be given pretty freely. In cases of moderate severity a tablespoonful of good old brandy or whiskey every four hours may suffice; but when the pulse is very rapid and thready, when there is much low delirium, tympanites, or sweating (indicating profound exhaustion), it may be advisable to give them in much larger quantities and at shorter intervals. The careful practitioner will closely watch the effects produced, and regulate the amount by the state of the patient, rather than by any fixed rule; but in severe cases, eight to twelve ounces of brandy, or even more, in the twenty-four hours may be given with decided benefit.

Venesection, both general and local, was long considered a sheet-anchor in this disease. Modern views are, however, entirely opposed to its use; and in a disease characterized by so profound an alteration of the blood, and so much prostration, it is too dangerous a remedy to employ, although it is possible that it might alleviate temporarily the severity of some of the symptoms, especially in cases in which peritonitis is well marked and much local pain and tenderness are present.

Medicinal Treatment.—The rational indications in medicinal treatment are to lessen the force of the circulation as much as is possible without favoring exhaustion; and to diminish the temperature.

Use of Arterial Sedatives.—For the former purpose, Barker strongly advocates the use of veratrum viride, in doses of five drops of the tincture every hour, until the pulse falls to below 100, when its effects are subsequently kept up by two or three drops every second hour. Of this drug I have no personal experience; but I have extensively used minute doses of tincture of aconite for the same purpose, and, when carefully given, I believe it to be a most valuable remedy. The way I have administered it is to give a single drop of the tincture, at first every half-hour, increasing the interval of administration according to the effect produced. Generally, after giving four or five doses at intervals of half an hour, the pulse begins to fall, and afterwards a few doses, at intervals of one or two hours, will suffice to prevent the heart's action rising to its former rapidity. The advantage of thus modifying cardiac action, with the view of preventing excessive waste of tissue, cannot be questioned. It is evident that so powerful a remedy must not be used without the most careful supervision, for, if continued too long, or given at too frequent intervals, it may unduly depress the circulation, and do more harm than good. It is necessary, therefore, that the practitioner should constantly watch the effect of the drug, and stop it if the pulse become very weak, or if it intermit. It is most likely to be useful at an early stage of the disease, before much exhaustion is present, and then only when the pulse is of a certain force and volume. Barker says of the veratrum viride, what is also true of aconite, that "it should not be given in those cases in which rapid prostration is manifested by a feeble, thread-like, irregular pulse, profuse sweats, and cold extremities."

The *reduction of temperature* is best obtained by quinine in tolerably large doses, of 10 to 15 grains, which may be given both morning and evening. After its exhibition the temperature frequently falls one or two degrees; and it is not common for any unpleasant head-symptoms to follow its use. Much advantage may probably be derived, when the temperature is very high, from the external use of cold, either in the form of cold sponging or the wet sheet. My experience of this agent is, however, too limited to enable me to speak of it with any confidence.

Amongst other remedies which have been used is turpentine, which was highly thought of by the Dublin school. In cases with much tympanitic distension, and a small weak pulse, it is sometimes of unquestionable value, and it probably acts as a strong nervine stimulant. Given in doses of 15 to 20 minims, rubbed up with mucilage, it can generally be taken in spite of its nauseous taste.

Evacuant Remedies.—Evacuants, in the shape of purgatives, diaphoretics, or even emetics, have often been employed as eliminants of the poison. The former are strongly recommended by Schroeder and other German authorities, and in this country they were formerly amongst the most favorite remedies. In the first volume of the "Obstetrical Journal" there is a paper by Mr. Morton, by whom this practice is strongly advocated, and some interesting cases are recorded in which it apparently acted well. He administers calomel in doses of 3 or 4 grains with compound extract of colocynth, so as to keep up a free action of the bowels. It seems quite reasonable that when there is constipation a gentle action of the bowels should be promoted by some mild aperient; but, bearing in mind that severe and exhausting diarrhœa is a common accompaniment of the disease, I should myself hesitate to run the risk of inducing it artificially, especially as there is no proof whatever that septic matter can really be eliminated in this way.

Internal Antiseptic Remedies.—It is possible that further research will give us some means of counteracting the septic state of the blood, and the sulphites and carbolates have been recommended for this purpose, but as yet with no reliable results.

The tincture of the perchloride of iron naturally suggests itself, from its well-known effects in surgical pyæmia. In the less intense forms of the disease, especially when local suppurations exist, it is certainly useful, and may be given in doses of 10 to 20 minims every 3 or 4 hours. In very acute cases, other remedies are more reliable, and the iron has the disadvantage of not unfrequently causing nausea or vomiting.

Opiates.—When restlessness, irritation, and want of sleep are prominent symptoms, sedatives may be required. Under such circumstances opiates may be given at night, and Battley's solution, nepenthe, or the hypodermic injection of morphia, are the forms which seem to answer best.

Treatment of Local Complications.—Pain and tenderness, and local complications, must be treated on general principles. The distress from them is most experienced when peritonitis is well marked. Here warm and moist applications, in the form of poultices or fomentations, are very useful. Relief is also sometimes obtained from turpentine stupes, and, when the tympanites is distressing, turpentine enemata are very serviceable. I have found the free application over the abdomen of the flexible collodium of the Pharmacopœia decidedly useful in alleviating the suffering from peritonitis.

Such are the remedies most used in the treatment of this disease. It is needless to say that it is quite impossible to lay down fixed rules for the management of any individual case; and it is obvious that, if puerperal septicæmia be not a special and distinct disease, its judicious management must depend on the general knowledge of the attendant, and on a careful study of the symptoms each separate case presents.

CHAPTER VI.

PUERPERAL VENOUS THROMBOSIS AND EMBOLISM.

Under the head of *thrombosis* we may class several important diseases connected with the puerperal state, which have received far less attention than they deserve. It is only of late years that some, we may probably safely say the majority, of those terribly sudden deaths which from time to time occur after delivery, have been traced to their true cause, viz., obstruction of the right side of the heart and pulmonary arteries from a blood-clot, either carried from a distance, or, as I shall hope to show, formed *in situ*. Although the result, and, to a great extent, the symptoms, are identical in both, still a careful consideration of the history of these two classes of cases tends to show that in their causation they are distinct, and that they ought not to be confounded together. In the former, in which the obstruction is caused by a clot carried from a distance, we have a secondary result of a clotting of blood in some part of the peripheral venous system; the separation of a portion of such a thrombus being an accident due to changes which it undergoes during retrograde metamorphosis tending to its eventual absorption. In the latter we have a local deposition of fibrine, the result of blood-changes consequent on pregnancy and the puerperal state. The formation of such a coagulum in vessels the complete obstruction of which is incompatible with life, explains the fatal results. When, however, the coagulum chances to be formed in more distant parts of the circulation, the vital functions are not immediately interfered with, and we have other phenomena occurring, due to the obstruction. The disease known as phlegmasia dolens, I shall presently attempt to show, is one of those secondary results of blood-clot forming in peripheral vessels. But from the evident and tangible symptoms it produces it has long been considered an essential and special disease, and the general blood dyscrasia which produces it, as well as other allied states, has not been studied separately. I shall hope to show that all these various conditions, dissimilar as they at first sight appear, are very closely connected, and that they are in fact due to a common cause; and thus, I think, we shall arrive at a clearer and more correct idea of their true nature than if we looked upon them as distinct and separate affections, as has been commonly done. I am aware that in phlegmasia dolens, the pathology of which has received perhaps more study than that of almost any other puerperal affection, something beyond simple obstruction of the venous system of the affected limb is probably required to account for the peculiar tense and shining swelling which is so characteristic. Whether this be an obstruction of the lymphatics, as Dr. Tilbury Fox and others have maintained with much show of reason, or whether it is some as yet undiscovered state, further investigation is required to show. But it is beyond any doubt that the important and essential part of the disease is the presence of a thrombus in the vessels; and I think it will not be difficult to prove that in its causation and history it is precisely similar to the more serious cases in which the pulmonary arteries are involved. It will be well to commence the study of the subject by a consideration of the conditions which, in the puerperal state, render the blood so peculiarly liable to coagulation, and we may then proceed to discuss the symptoms and results of the formation of coagula in various parts of the circulatory system.

The researches of Virchow, Benj. Ball, Humphrey, Richardson, and others, have rendered us tolerably familiar with the conditions which favor the coagulation of the blood in the vessels. These are chiefly: 1. A stagnant or arrested circulation; as, for example, as has been pointed out by Moxon,[1] when the blood coagulates in the veins which draw blood from the gluteal region in old and bedridden people, or as in some forms of pulmonary thrombosis, where the clots in the arteries are probably the result of obstruction in the circulation through the lung capillaries, as in certain cases of emphysema, pneumonia, or pulmonary apoplexy. 2. A mechanical obstruction around which coagula form, as in certain morbid states of the vessels, or, a better example still, secondary coagula which form around a travelled embolus impacted in the pulmonary arteries. 3. And most important of all, in which the coagulation is the result of some morbid state of the blood itself, by which the tendency to the deposition of fibrine is increased. Examples of this latter condition are frequently met with in the course of various diseases, such as rheumatism or fever, in which the quantity of fibrine is increased, and the blood itself is loaded with morbid material. Thrombosis from this cause is of by no means unfrequent occurrence after severe surgical operations, especially such as have been attended with much hemorrhage, or when the patient is in a weak and anæmic condition. This has been specially dwelt upon as a not unfrequent source of death after operation, by Fayrer and other surgeons.[1]

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[1] Guy's Hospital Reports, 1869.

But little consideration is required to show why thrombosis plays so important a part in the puerperal state, for there most of the causes favoring its occurrence are of necessity present. Probably there is no other condition in which they exist in so marked a degree or are so frequently combined. The blood itself contains an excess of fibrine, which largely increases towards the latter months of utero-gestation, until, as has been pointed out by Andral and Gavarret, it not unfrequently contains more than a third of the average amount present in the non-pregnant state. As soon as delivery is completed, other causes of blood dyscrasia come into operation. Involution of the largely hypertrophied uterus commences, and the blood is charged with a quantity of effete material, which must be present, in greater or less amount, until that process is completed. It is an old observation that phlegmasia dolens is of very common occurrence in patients who have lost much blood during labor: thus, Dr. Leishman says, "In no class of cases has it been so frequently observed as in women whose strength has been reduced to a low ebb by hemorrhage, either during or after labor; and this, no doubt, accounts for the observation made by Merriman that it is relatively a common occurrence after placenta prævia."[2] An examination of the cases in which death results from pulmonary thrombosis shows precisely the same facts, as in a large proportion of them severe post-partum hemorrhage is stated to have occurred. The exhaustion following the excessive losses so common after labor must of itself strongly predispose to thrombosis, and, indeed, loss of blood has been distinctly pointed out by Richardson to be one of its most common antecedents. "There is," he observes, "a condition which has been long known to favor coagulation and fibrinous deposition. I mean loss of blood, and syncope or exhaustion during impoverished states of the body."

Since, then, so many of the predisposing causes of thrombosis are present in the puerperal state, it is hardly a matter of astonishment that it should be of frequent occurrence, or that it should lead to conditions of serious gravity. And yet the attention of the profession has been for the most part limited to a study of one only of the results of this tendency to blood-clotting after delivery, no doubt because of its comparative frequency and evident symptoms. True, the balance of professional opinion has lately held that phlegmasia dolens is chiefly the result of some morbid condition of the blood producing plugging of the veins; but the wider view which I am attempting to maintain, which would bring this disease into close relation with the more rarely observed but infinitely important obstructions of the pulmonary arteries, has scarcely, if at all, been insisted on. Doubtless farther investigation will show that it is not in these parts of the venous system alone that puerperal thrombosis occurs; but the symptoms and effects of venous obstruction elsewhere, important though they may be, are unknown, and for the present I must content myself with dwelling on it as it occurs in them. I propose, then, to describe the symptoms and pathology, so far as they are yet known to us, of blood-clot as it occurs in the right side of the heart and pulmonary artery. It may be useful here to repeat that this is essentially distinct from embolism of the same parts. The latter is obstruction due to the impaction of a separated portion of a thrombus formed elsewhere, and for its production it is essential that thrombosis should have preceded it. Embolism is in fact an accident of thrombosis, not a primary affection. The condition I am now discussing I hold to be primary, precisely similar in its causation to the venous obstruction which, in other situations, gives rise to phlegmasia dolens.

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[1] Edin. Med. Jour., March, 1861; Indian Annals of Med., July, 1867.

[2] Leishman, System of Obstetrics, p. 710.

At the threshold of this inquiry we have to meet the objection, started by several who have written on this subject,[1] that spontaneous coagulation of the blood in the right side of the heart and pulmonary arteries is a mechanical and physiological impossibility. This was the view of Virchow, who, with his followers, maintained that whenever death from pulmonary obstruction occurred, an embolus was of necessity the starting-point of the malady, and the nucleus round which secondary deposition of fibrine took place. Virchow holds that the primary factor in thrombosis is a stagnant state of the blood, and that the impulse imparted to the blood by the right ventricle is of itself sufficient to prevent coagulation. It is to be observed that these objections are purely theoretical. Without denying that there is considerable force in the arguments adduced, I think that the clinical history of these cases strongly favors the view of spontaneous coagulation; and I would apply to the theoretical objections advanced the arguments used by one of their strongest upholders, with regard to another disputed point: "Je préfère laisser la parole aux faits, car devant eux la théorie s'incline."[2]

The anatomical arrangement of the pulmonary arteries shows how spontaneous coagulation may be favored in them; for, as Dr. Humphrey has pointed out,[3] "the artery breaks up at once into a number of branches, which radiate from it, at different angles, to the several parts of the lungs. Consequently, a large extent of surface is presented to the blood, and there are numerous angular projections into the currents; both which conditions are calculated to induce the spontaneous coagulation of the fibrine." We know also, that thrombosis generally occurs in patients of feeble constitution, often debilitated by hemorrhage, in whom the action of the heart is much weakened. These facts of themselves go far to meet the objections of those who deny the possibility of spontaneous coagulation at the roots of the pulmonary arteries.

The records of post-mortem examinations show also that in many of the cases the right side of the heart, as well as the larger branches of the pulmonary arteries, contained firm, leathery, decolorized, and laminated coagula, which could not have been recently formed. The advocates of the purely embolic theory maintain that these are secondary coagula, formed around an embolus. But surely the mechanical causes which are sufficient to prevent the spontaneous deposition of fibrine would also suffice to prevent its gathering round an embolus; unless, indeed, the obstruction was sufficient to arrest the circulation altogether, when death would occur before there was any time for secondary deposit. Before we can admit the possibility of embolism we must have at least one factor, the existence of thrombosis in a peripheral vessel, from which an embolism can come. In many of the recorded cases nothing of the kind was found; and although, as is argued, this may have been overlooked, yet such an oversight can hardly always have been made.

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[1] See especially Bertin des Embolies, p. 46 et seq.

[2] Bertin des Embolies, p. 149.

[3] Humphrey, On the Coagulation of the Blood in the Venous System during Life.

The strongest argument, however, in favor of the spontaneous origin of pulmonary thrombosis is one which I originally pointed out in a series of papers "On Thrombosis and Embolism of the Pulmonary Artery as a Cause of Death in the Puerperal State."[1] I there showed, from a careful analysis of 25 cases of sudden death after delivery in which accurate post-mortem examination had been made, that cases of spontaneous thrombosis and true embolism may be divided from each other by a clear line of demarcation, depending on the period after delivery at which the fatal result occurs. In 7 out of these 25 cases there was distinct evidence of true embolism, and in them the death occurred at a remote period after delivery; in none before the nineteenth day. This contrasts remarkably with the cases in which the post-mortem examination afforded no evidence of embolism. These amounted to 15 out of the 25; and in all of them, with one exception, death occurred before the fourteenth day, often on the second or third. The reason of this seems to be that, in the former, time is required to admit of degenerative changes taking place in the deposited fibrine leading to separation of an embolus; while in the latter the thrombosis corresponds in time, and to a great extent no doubt also in cause, to the original peripheral thrombosis from which, in the former, the embolus was derived. Many cases I have since collected illustrate the same rule in a very curious and instructive way.

Another clinical fact I have observed points to the same conclusion. In one or two cases distinct signs of pulmonary obstruction have shown themselves without proving immediately fatal, and shortly *afterwards* peripheral thrombosis, as evidenced by phlegmasia dolens of one extremity, has commenced. Here the peripheral thrombosis obviously followed the central, both being produced by identical causes, and the order of events necessary to uphold the purely embolic theory was reversed.

I hold, then, that those who deny the possibility of spontaneous coagulation in the heart and pulmonary arteries do so on insufficient grounds, and that we may consider it to be an occurrence, rare, no doubt, but still sufficiently often met with, and certainly of sufficient importance, to merit very careful study.

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[1] Lancet, 18

Dr. Meigs, of Philadelphia, was one of the first to direct attention to spontaneous coagulation of the blood in the right side of the heart and pulmonary arteries, as a cause of sudden death in the puerperal state. The occurrence itself, however, had been carefully studied by Paget, whose paper was published in 1845, four years before Meigs wrote on the subject.[1] It is true that none of Paget's cases happened after delivery; but he none the less clearly apprehended the nature of the obstruction. In 1855, Hecker[2] attributed the majority of these cases to embolism proper; and since that date most authors have taken the same view, believing that spontaneous coagulation only occurs in exceptional cases, such as those in which, on account of some obstruction in the lung, or in the debility of the last few hours before death, coagula form in the smaller ramifications of the pulmonary arteries, and gradually creep backwards towards the heart.

The symptoms can hardly be mistaken; and there seems to be no essential difference between the symptomatology of spontaneous and embolic obstruction, so that the same description will suffice for both. In a large proportion of cases the attack comes on with an appalling suddenness which forms one of its most striking characteristics. Nothing in the condition of the patient need have given rise to the least suspicion of impending mischief, when, all at once, an intense and horrible dyspnœa comes on; the patient gasps and struggles for breath, tears off the coverings from her chest in a vain endeavor to get more air, and, too often, dies in a few minutes, long before medical aid can be had, with all the symptoms of asphyxia. The muscles of the face and thorax are violently agitated in the attempt to oxygenate the blood, and an appearance closely resembling an epileptic convulsion may be presented. The face may be either pale or deeply cyanosed. Thus, in one case I have elsewhere recorded, which was an undoubted example of true embolism, Mr. Pedler, the resident accoucheur at King's College Hospital, who was present during the attack, writes of the patient,[3] "She was suffering from extreme dyspnœa, the countenance was excessively pale, her lips white, the face generally expressing deep anxiety." In another, which was probably an example of spontaneous thrombosis,[4] occurring on the twelfth day after delivery, it is stated that "the face had assumed a livid purple hue, which was so remarkable as to attract the attention both of the nurse and of her mother, who was with her." The extreme embarrassment of the circulation is shown by the tumultuous and irregular action of the heart, in its endeavor to send the venous blood through the obstructed arteries. Soon it gets exhausted, as shown by its feeble and fluttering beat. The pulse is thread-like, and nearly imperceptible, the respirations short and hurried, but air may be heard entering the lungs freely. The intelligence during the struggle is unimpaired; and the dreadful consciousness of impending death adds not a little to the patient's sufferings and to the terror of the scene. Such is an imperfect account of the symptoms, gathered from a record of what has been observed in fatal cases. It will be readily understood why, in the presence of so sudden and awful an attack, symptoms have not been recorded with the accuracy of ordinary clinical observation.

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[1] Med.-Chir. Trans., vol. xxvii. p. 162, and vol. xxviii. p. 352. Philadelphia Medical Examiner, 1849.

[2] Deutsche Klinik, 1855.

[3] Brit. Med. Journ., March 27, 1869.

[4] Obst. Trans., vol. xii. p. 194.

Is Recovery Possible?—A question of great practical interest, and one which has been entirely overlooked by writers on the subject, is, Have we any ground for supposing that there is a possibility of recovery after symptoms of pulmonary obstruction have developed themselves? That such a result must be of extreme rarity is beyond question; but I have little doubt that in some few cases, entirely inexplicable on any other hypothesis, life is prolonged until the coagulum is absorbed and the pulmonary circulation restored. In order to admit of this it is, of course, essential that the obstruction be not sufficient to prevent the passage of a certain quantity of blood to the lungs, to carry on the vital functions. The history of many cases tends to show that the obstructing clot was present for a considerable time before death, and that it was only when some sudden exertion was made, such as rising from bed, or the like, calling for an increased supply of blood which could not pass through the occluded arteries, that fatal symptoms manifested themselves. This was long ago pointed out by Paget,[1] who says, "The case proves that, in certain circumstances, a great part of the pulmonary circulation may be arrested in the course of a week (or a few days more or less), without immediate danger to life, or any indication of what had happened." And, after referring to some illustrative cases, "Yet in all these cases the characters of the clots by which the pulmonary arteries were obstructed showed plainly that they had been a week or more in the process of formation." If we admit the possibility of the continuance of life for a certain time, we must, I think, also admit the possibility, in a few rare cases, of eventual complete recovery. What is required is time for the absorption of the clot. In the peripheral venous system coagula are constantly removed by absorption. So strong, indeed, is the tendency to this, that Humphrey observes with regard to it, "It appears that the blood is almost sure to revert to its natural channel in process of time."[2] If, then, the obstruction be only partial, if sufficient blood pass to keep the patient alive, and a sudden supply of oxygenated blood is not demanded by any exertion which the embarrassed circulation is unable to meet, it is not inconceivable that the patient may live until the obstruction is removed.

Such I believe to be the only explanation of certain cases, some of which on any other hypothesis it is impossible to understand. The symptoms are precisely those of pulmonary obstruction, and the description I have given above may be applied to them in every particular; and after repeated paroxysms, each of which seems to threaten immediate dissolution, an eventual recovery takes place. What, then, I am entitled to ask, can the condition be, if not that which I suggest? As the question I am considering has never, so far as I am aware, been treated of by any other writer, I may be permitted very briefly to state the facts of one or two of the cases on which I found my argument, some of which I have already published in detail elsewhere.

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[1] Op. cit., p. 358.

[2] Med.-Chir. Trans., vol. xxvii. p. 14.

K. H., delicate young lady. Labor easy. First child. Profuse post-partum hemorrhage. Did well until the seventh day, during the whole of which she felt weak. Same day an alarming attack of dyspnœa came on. For several days she remained in a very critical condition, the slightest exertion bringing on the attacks. A slight blowing murmur heard for a few days at the base of the heart, and then disappeared. For two months patient remained in the same state. As long as she was in the recumbent position, she felt pretty comfortable; but any attempt at sitting up in bed, or any unusual exertion, immediately brought on the embarrassed respiration. During all this time it was found necessary to administer stimulants profusely to ward off the attacks. Eventually the patient recovered completely.

Q. F., æt. 44. Mother of twelve children. Confined on July 6. On the 11th day she went to bed feeling well. There was no swelling or discomfort of any kind about the lower extremities at this time. About half-past 3 A.M. she was sitting up in bed, when she was suddenly attacked with an indescribable sense of oppression in the chest, and fell back in a semi-unconscious state, gasping for breath. She remained in a very critical condition, with the same symptoms of embarrassed respiration, for three days, when they gradually passed away. Two days *after* the attack, phlegmasia dolens came on, the left leg swelled, and remained so for several months.

This case is an example of the fact I have already referred to, of phlegmasia dolens coming on *after* the symptoms of pulmonary obstruction had manifested themselves; the inference being that both depended on similar causes operating on two distinct parts of the circulatory system.

C. H., æt. 24. Confined of her first child on August 20, 1867. Thirty hours after delivery she complained of great weakness and dyspnœa. This was alleviated by the treatment employed, but on the ninth day, after making a sudden exertion, the dyspnœa returned with increased violence, and continued unabated until I saw the patient on September 4, fourteen days after her confinement. The following are the notes of her condition made at the time of the visit: "I found her sitting on the sofa, propped up with pillows, as she said she could not breathe in the recumbent position. The least excitement or talking brought on the most aggravated dyspnœa, which was so bad as to threaten almost instant death. Her sufferings during these paroxysms were terrible to witness. She panted and struggled for breath, and her chest heaved with short gasping respirations. She could not even bear any one to stand in front of her, waving them away with her hand, and calling for more air. These attacks were very frequent, and were brought on by the most trivial causes. She talked in a low, suppressed voice, as if she could not spare breath for articulation. On auscultation, air was found to enter the lungs freely in every direction, both in front and behind. Immediately over the site of the pulmonary arteries there was a distinct harsh, rasping murmur, confined to a very limited space, and not propagated either upwards or downwards. The heart-sounds were feeble and tumultuous." These symptoms led me to diagnose pulmonary obstruction, and I, of course, gave a most unfavorable prognosis, but to my great surprise the patient slowly recovered. I saw her again six weeks later, when her heart-sounds were regular and distinct, and the murmur had completely disappeared.

E. E., æt. 42, was confined for the first time on November 5, 1873, in the sixth month of utero-gestation. She had severe post-partum hemorrhage, depending on partially adherent placenta, which was removed artificially. She did perfectly well until the 14th day after delivery, when she was suddenly attacked with intense dyspnœa, aggravated in paroxysms. Pulse pretty full, 130, but distinctly intermittent. Air entered lungs freely. The heart's action was fluttering and irregular, and at the juncture of the fourth and fifth ribs with the sternum there was a loud blowing systolic murmur. This was certainly non-existent before, as the heart had been carefully auscultated before administering chloroform during labor. For two days the patient remained in the same state, her death being almost momentarily expected. On the 21st, that is, two days *after* the appearance of the chest-symptoms, phlegmasia dolens of a severe kind developed itself in the right thigh and leg. She continued in the same state for many days, lying more or less tranquilly, but having paroxysms of the most intense apnœa, varying from two to six or eight in the twenty-four hours. No one who saw her in one of these could have expected her to live through it. Shortly after the first appearance of the paroxysms it was observed that the cellular tissue of the neck and part of the face became swollen and œdematous, giving an appearance not unlike that of phlegmasia dolens. The attacks were always relieved by stimulants. These she incessantly called for, declaring that she felt they kept her alive. During all this time the mind was clear and collected. The pulse varied from 110 to 130. Respirations about 60. T. 101° to 102.5°. By slow degrees the patient seemed to be rallying. The paroxysms diminished in number, and after December 1 she never had another, and the breathing became free and easy. The pulse fell to 80, and the cardiac murmur entirely disappeared. The patient remained, however, very weak and feeble, and the debility seemed to increase. Towards the second week in December she became delirious, and died, apparently exhausted, without any fresh chest-symptoms, on the 19th of that month. No post-mortem examination was allowed.

I have narrated this case, although it terminated fatally, because I hold it to be one of the class I am considering. The death was certainly not due to the obstruction, all symptoms of which had disappeared, but apparently to exhaustion from the severity of the former illness. It illustrates, too, the simultaneous appearance of symptoms of pulmonary obstruction and peripheral thrombosis. The swelling of the neck was a curious symptom, which has not been recorded in any other cases, and may possibly be a further proof of the analogy between this condition and phlegmasia dolens.

Now, it may, of course, be argued that these cases do not prove my thesis, inasmuch as I only assume the presence of a coagulum. But I may fairly ask, in return, what other condition could possibly explain the symptoms? They are precisely those which are noticed in death from undoubted pulmonary obstruction. No one seeing one of them, or even reading an account of the symptoms, while ignorant of the result, could hesitate a single instant in the diagnosis. Surely, then, the inference is fair that they depended on the same cause. In the very nature of things, my hypothesis cannot be verified by post-mortem examination; but there is at least one case on record in which, after similar symptoms, a clot was actually found. The case is related by Dr. Richardson.[1] It was that of a man who for weeks had symptoms precisely similar to those observed in the cases I have narrated. In one of his agonizing struggles for breath he died; and after death it was found "that a fibrinous band, having its hold in the ventricle, extended into the pulmonary artery." This observation proves to a certainty that life may continue for weeks after the deposition of a coagulum; and, moreover, this condition was precisely what we should anticipate, since, of course, the obstructing coagulum must necessarily be small; otherwise the vital functions would be immediately arrested.

There is a symptom noted in two of the above cases, and to less extent in a third, which has not been mentioned in any account of fatal cases occurring after delivery, viz., the presence of a distinct murmur over the site of the pulmonary arteries. It is a sign we should naturally expect, and it proves that the cause of the disease was at least cardiac.

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[1] Clinical Essays, p. 224 et seq.

Very possibly it would be met with in fatal cases if attention were particularly directed to it. In both these instances it was exceedingly well marked, and in both it entirely disappeared when the symptoms abated. The probability of such a murmur being audible in cases of thrombosis of the pulmonary artery has been recognized by one of our highest authorities in cardiac disease, who actually observed it in a non-puerperal case. In the last edition of his work on diseases of the heart, Dr. Walshe[1] says, "The only physical condition connected with the vessel itself would probably be systolic basic murmur following the course of the pulmonary main trunk and of its immediate divisions to the left and right of the sternum. This sign I most certainly heard in an old gentleman whose life was brought to a sudden close, in the course of an acute affection, by coagulation in the pulmonary artery, and to a moderate extent in the right ventricle."

Similar cases have probably been overlooked or misinterpreted. Many seem to have been attributed to shock, in the absence of a better explanation, a condition to which they bear no kind of resemblance.

Causes of Death.—The precise mode of death in pulmonary obstruction, whether dependent on thrombosis or embolism, has given rise to considerable difference of opinion. Virchow attributes it to syncope[2] depending on stoppage of the cardiac contraction. Panum,[3] on the other hand, contests this view, maintaining that the heart continues to beat even after all signs of life have ceased. Certainly tumultuous and irregular pulsations of the heart are a prominent symptom in most of the recorded cases, and are not reconcilable with the idea of syncope. Panum's own theory is that death is the result of cerebral anæmia. Paget seems to think that the mode of death is altogether peculiar, in some respects resembling syncope, in others anæmia. Bertin, who has discussed the subject at great length, attributes the fatal result purely to asphyxia. The condition, indeed, is in all respects similar to that state; the oxygenation of the blood being prevented, not because air cannot get to the blood, but because blood cannot get to the air. The symptoms also seem best explained by this theory; the intense dyspnœa, the terrible struggle for air, the preservation of intelligence, the tumultuous action of the heart, are certainly not characteristic either of syncope or anæmia.

Post-mortem Appearances of Clots.—The anatomical character of the clots seems to vary considerably. Ball, by whom they have been most carefully described, believes that they generally commence in the smaller ramifications of the arteries, extending backwards towards the heart, and filling the vessels more or less completely. Towards its cardiac extremity the coagulum terminates in a rounded head, in which respect it resembles coagula spontaneously formed in the peripheral veins. They are non-adherent to the coats of the vessels, and the blood circulates, when it can do so at all, between them and the vascular walls. Such clots are white, dense, and of a homogeneous structure, consisting of layers of decolorized fibrine, firm at the periphery, where the fibrine

[1] Walshe On Diseases of the Heart, 4th ed., 1873.

[2] Gesamm. Abhandl., 1862, p. 316.

[3] Virchow, Archiv, 1863.

has been most recently deposited, and softened in the centre, where amylaceous or fatty degeneration has commenced. Ball maintains that if the coagulum have commenced in the larger branches of the arteries it must have first begun in the heart, and extended into them from the ventricle. According to Humphrey, the same changes take place in pulmonary as in peripheral thrombi, and they may become adherent to the walls of the vessels, or converted into threads or bands. When the obstruction is due to embolism, provided the case is a well-marked one, and the embolus of some size, the appearances presented are different. We have no longer a laminated and decolorized coagulum, with a rounded head, similar to a peripheral thrombus. The obstruction in this case generally takes place at the point of bifurcation of the artery, and we there meet with a grayish-white mass, contrasting remarkably with the more recently-deposited fibrine before and behind it. It may be that the form of the embolus shows that it has recently been separated from a clot elsewhere; and in many cases it has been possible to fit the travelled portion to the extremity of the clot from which it has been broken. We may also, perhaps, find that the embolus has undergone an amount of retrograde metamorphosis corresponding with that of the peripheral thrombus from which we suppose it to have come, but differing from that of the more recently-deposited fibrine around it. It must be admitted, however, that the anatomical peculiarities of the coagula will by no means always enable us to trace them to their true origin. In many cases emboli may escape detection from their smallness, or from the quantity of fibrine surrounding them.

Treatment.—But few words need be said as to the treatment of pulmonary obstruction. In a large majority of cases the fatal result so rapidly follows the appearance of the symptoms that no time is given us even to make an attempt to alleviate the patient's sufferings. Should we meet with a case not immediately fatal, it seems that there are but two indications of treatment affording the slightest rational ground of hope.

1. To keep the patient alive by the administration of stimulants—brandy, ether, ammonia, and the like, to be repeated at intervals corresponding to the intensity of the paroxysms, and the results produced. In the cases I have above narrated, in which recovery ensued, this took the place of all other medication. Possibly leeches, or dry cupping to the chest, might prove of some service in relieving the circulation.

2. To enjoin the most absolute and complete repose. The object of this is evident. The only chance for the patient seems to be that the vital functions should be carried on until the coagulum has been absorbed, or, at least, until it has been so much lessened in size as to admit of blood passing it to the lungs. The slightest movements may give rise to a fatal paroxysm of dyspnœa, from the increased supply of oxygenated blood required. It must not be forgotten that in a large proportion of cases death immediately followed some exertion in itself trivial, such as rising out of bed. Too much attention, then, cannot be given to this point. The patient should be absolutely still; she should be fed with abundance of fluid food, such as milk, strong soups, and the like; and should on no account be permitted to raise herself in bed or

attempt the slightest muscular exertion. If we are fortunate enough to meet with a case apparently tending to recovery, these precautions must be carried on long after the severity of the symptoms has lessened; for a moment's imprudence may suffice to bring them back in all their original intensity.

Bertin,[1] indeed, recommends a system of treatment very different from this. In the vain hope that the violent effort induced may cause the displacement of the impacted embolus (to which alone he attributes pulmonary obstruction), he recommends the administration of emetics. Few, I fancy, will be found bold enough to attempt so hazardous a plan of treatment.

Various drugs have been suggested in these cases. Richardson recommended ammonia, a deficiency of which he at that time believed to be the chief cause of coagulation. He has since advised that liquor ammoniæ should be given in large doses, 20 minims every hour, in the hope of causing solution of the deposited fibrine; and he has stated that he has seen good results from the practice. Others advise the administration of alkalies, in the hope that they may favor absorption. The best that can be said for them is, that they are not likely to do much harm.

CHAPTER VII.

PUERPERAL ARTERIAL THROMBOSIS AND EMBOLISM.

THE same condition of the blood which so strongly predisposes to coagulation in the vessels through which venous blood circulates, tends to analogous results in the arterial system. These, however, are by no means so common, and do not, as a rule, lead to such important consequences. The subject has been but little studied, and almost all our knowledge of it is derived from a very interesting essay by Sir James Simpson.[2] As I have devoted so much space to the consideration of venous thrombosis and embolism, I shall but briefly consider the effects of arterial obstruction.

Causes.—In a considerable number of the recorded cases the obstruction has resulted from the detachment of vegetations deposited on the cardiac valves, the result of endocarditis, either produced by antecedent rheumatism or as a complication of the puerperal state. Sometimes the obstruction seems to depend on some general blood dyscrasia, similar to that producing venous thrombosis, or on some local change in the artery itself. Thus, Simpson records a case apparently produced by local arteritis, which caused acute gangrene of both lower extremities, ending fatally in the third week after delivery. In other cases it has been attributed to coagulation following spontaneous laceration and corrugation of the internal coat of the artery.

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[1] Op. cit., p. 393.

[2] Selected Obst. Works, vol. i. p. 523.

The *symptoms* of puerperal arterial obstruction must, of course, vary with the particular arteries affected. Those with the obstruction of which we are most familiar are the cerebral, the humeral, and the femoral. The effects produced must also be modified by the size of the embolus, and the more or less complete obstruction it produces. Thus, for example, if the middle cerebral artery be blocked up entirely, the functions of those portions of the brain supplied by it will be more or less completely arrested, and hemiplegia of the opposite side of the body, followed by softening of the brain-textûre, will probably result. If the nervous symptoms be developed gradually, or increase in intensity after their first appearance, it may be that an obstruction, at first incomplete, has increased by the deposition of fibrine around it. So the occasional sudden supervention of blindness, with destruction of the eyeball—cases of which are recorded by Simpson—not improbably depends on occlusion of the ophthalmic artery, the function of the organ depending on its supply through the single artery. The effects of obstruction of the visceral arteries in the puerperal state are entirely unknown; but it is far from unlikely that farther investigation may prove them to be of great importance. In the extremities, arterial obstruction produces effects which are well marked. They are classified by Simpson under the following heads: 1. *Arrest of pulse below the site of obstruction.*—This has been observed to come on either suddenly or gradually, and if the occlusion be in one of the large arterial trunks, it is a symptom which a careful examination will readily enable us to detect. 2. *Increased force of pulsation in the arteries above the seat of obstruction.* 3. *Fall in the temperature of the limb.*—This is a symptom which is also easily appreciable by the thermometer, and, when the main artery of the limb is occluded, the coldness of the extremity is well marked. 4. *Lesions of motor and sensory functions, paralysis, neuralgia, &c., &c.*—Loss of power in the affected limb is often a prominent symptom, and when it comes on suddenly, and is complete, the main artery will probably be occluded. It may be diagnosed from paralysis depending on cerebral or spinal causes by the absence of head-symptoms, by the history of the attack, and by the presence of other indications of arterial obstruction, such as loss of pulsation in the artery, fall of temperature, &c. The sensory functions in these cases are generally also seriously disturbed, not so much by loss of sensation as by severe pain and neuralgia. Sometimes the pain has been excessive, and occasionally it has been the first symptom which directed attention to the state of the limb. 5. *Gangrene below or beyond the seat of arterial obstruction.*—Several interesting cases are recorded in which gangrene has followed arterial obstruction. Generally speaking, gangrene will not follow occlusion of the main arterial trunk of an extremity, as the collateral circulation becomes soon sufficiently developed to maintain its vitality. In many of the cases either thrombi have obstructed the channels of collateral circulation as well, or the veins of the limb have also been blocked up. When such extensive obstructions occur, they obviously cannot be embolic, but must depend on a local thrombosis, traceable to some general blood dyscrasia depending on the puerperal state.

Treatment.—Little can be said as to the treatment of such cases, which must vary with the gravity and nature of the symptoms in each. Beyond absolute rest (in the hope of eventual absorption of the thrombus or embolus), generous diet, attention to the general health of the patient, and sedative applications to relieve the local pain, there is little in our power. Should gangrene of an extremity supervene in a puerperal patient, the case must necessarily be wellnigh hopeless. Simpson, however, records one instance in which amputation was performed above the line of demarcation, the patient eventually recovering.

CHAPTER VIII.

OTHER CAUSES OF SUDDEN DEATH DURING LABOR AND THE PUERPERAL STATE.

A LARGE number of the cases in which sudden death occurs during or after delivery find their explanation, as I have already pointed out, in thrombosis or embolism of the heart and pulmonary arteries. Probably many cases of the so-called *idiopathic asphyxia* were in fact examples of this accident, the true nature of which had been misunderstood. Besides these there are, no doubt, many other conditions which may lead to a suddenly fatal result in connection with parturition.

Some of these are of an organic, others of a functional nature.

Organic Causes.—Among the former may be mentioned cases in which the straining efforts of the second stage of labor have produced death in patients suffering from some pre-existent disease of the heart. Rupture of that organ has probably occurred from fatty degeneration of its walls. Dehous[1] narrates an instance in which the efforts of labor caused the rupture of an aneurism. Another case, from interference with the action of the heart in a patient who had pericardial effusion, is narrated by Ramsbotham. Dr. Devilliers relates an instance occurring in a young woman during the second stage of labor. The heart was found to be healthy, but the lungs were intensely congested, and blood was extensively extravasated all through their texture. This was probably caused by pulmonary congestion and apoplexy, produced by the severe straining efforts. Many cases from effusion of blood in the brain-substance, or on its surface, are on record, no doubt in patients who, from arterial degeneration or other causes, were predisposed to apoplectic effusions. The so-called apoplectic convulsions, formerly described in most works on obstetrics as a variety of puerperal convulsions, are evidently nothing more than apoplexy coming on during or after labor. As regards their pathology, they do not seem to differ from ordinary cases of apoplexy in the non-pregnant condition. One example is recorded of death which was attributed to rupture of the diaphragm from excessive action in the second stage.

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[1] Dehous, Sur les Morts subites.

Functional Causes.—Among the causes of death which cannot be traced to some distinct organic lesion may be classed cases of syncope, shock, and exhaustion. Many instances of this kind are recorded. Thus, in some women of susceptible nervous organization the severity of the suffering appears to bring on a condition similar to that produced by excessive shock or exhaustion, which has not unfrequently proved fatal. Several examples of this kind have been cited by McClintock.[1] It is also not unlikely that sudden syncope sometimes produces a fatal result, during or after labor. Most cases of death otherwise inexplicable used to be referred to this cause; but accurate autopsies were seldom made; and even when they were, the important effects of pulmonary coagula being unknown, it is more than probable that the true cause of death was overlooked. It has been supposed that the sudden removal of pressure from the veins of the abdomen, by the emptying of the gravid uterus after delivery, may favor an increased afflux of blood into the lower parts of the body, and thus tend to an anæmic condition of the brain, and the production of syncope. However this may be, the possibility of its occurrence, and its manifest danger in a recently delivered woman, are sufficient reasons for enforcing the recumbent position after labor is over. In some of the cases the syncope was evidently produced by the patient's suddenly sitting upright.

Death from Air in the Veins.—Some cases of sudden death immediately after labor seem to be due to the entrance of air into the veins. Six examples are cited by McClintock which were probably due to this cause. Lachapelle relates two. An interesting case is related by M. Lionet.[2] In this the patient died five and a half hours after an easy and natural labor, the chief symptoms being extreme pallor, efforts at vomiting, and dyspnœa. Air was found in the heart and in the arachnoid veins. There can be no question that the uterine sinuses after delivery are nearly as well adapted as the veins of the neck for facilitating the entrance of air. They are firmly attached to the muscular walls of the uterus, so that they gape open when that organ is relaxed, and it is easy to understand how air might enter. Indeed, in the post-mortem examination in one of the cases occurring in the practice of Mme. Lachapelle, it is stated that "the uterine sinuses opened in the interior of the uterus by large orifices (one line and a half in diameter), through which air could readily be blown as far as the iliac veins, and *vice versa*." The condition of the uterus after delivery also enables the air to have ready access to the mouths of the sinuses, for the alternate relaxation and contraction of the uterus, occurring after the placenta is expelled, would tend to draw in the air as by a suction-pump. Hence an additional reason for insisting on firm contraction of the uterus, as this will lessen the risk of this accident.

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[1] Union Médicale, 1853.

[2] Dehosu

The precise mechanism of death from air in the veins has been a subject of dispute among pathologists. By Bichat[1] it was referred to anæmia and syncope from want of blood in the vessels of the brain, which were occupied by air; Nysten[2] attributed it to distension of the cavities of the heart by rarefied air, producing paralysis of its walls; Geroy, to a stoppage of the pulmonary circulation, and consequent want of proper blood-supply to the left heart; while Leroy d'Etiolles thought it might depend on any of these causes, or a combination of all of them. These, and many other hypotheses on the subject, have been advanced, to all of which serious objection could be raised. The most recent theory is one maintained by Virchow and Oppolzer,[3] and more recently by Feltz, which attributes the fatal results to impaction of the air-globules in the lesser divisions of the pulmonary arteries, where they form gaseous emboli, and cause death exactly in the same way as when the obstruction depends on a fibrinous embolism. The symptoms observed in fatal cases closely correspond to those of pulmonary obstruction, and it is not unlikely that some cases attributed to other causes may really depend on the entrance of air through the uterine sinuses. Such, for example, was most probably the explanation of a case referred to by Dr. Graily Hewitt in a discussion at the Obstetrical Society.[4] Death occurred shortly after the removal of an adherent placenta, during which, no doubt, air could readily enter the uterine cavity. The symptoms, viz., "severe pain in the cardiac region, distress as regards respiration, and pulselessness," are identical with those of pulmonary obstruction. Dr. Hewitt refers the death to shock, which certainly does not generally produce such phenomena.

CHAPTER IX.

PERIPHERAL VENOUS THROMBOSIS—(SYN.: CRURAL PHLEBITIS—PHLEGMASIA DOLENS—ANASARCA SEROSA—ŒDEMA LACTEUM—WHITE LEG, ETC.)

WE now come to discuss the symptoms and pathology of the conditions associated with the formation of thrombi in the peripheral venous system, or rather in the veins of the lower extremities, since too little is known of their occurrence in other parts to enable us to say anything on the subject.

The most important of these is the well-known disease which, under the name of *phlegmasia dolens*, has attracted much attention, and given rise to numerous theories as to its nature and pathology. In describing it as a local manifestation of a general blood dyscrasia, and not as an essential local disease, I am making an assumption as to its pathology that many eminent authorities would not consider justifiable. I have, however, already stated some of the reasons for so doing, and I shall shortly hope to show that this view is not incompatible with the most probable explanation of the peculiar state of the affected limb.

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[1] Recherches sur la Vie et la Mort, 1853.

[2] Nysten, Recherches de Phys. et Chem. Path., 1811.

[3] Casuistik des Embolie, Wiener Med. Woch., 1863. Des Embolies Capillaires, 1868, op. cit., p. 115.

[4] Obstet. Trans., vol. x. p. 28.

Symptoms.—The first symptom that usually attracts attention is severe pain in some part of the limb that is about to be affected. The character of the pain varies in different cases. In some it is extremely acute, and is most felt in the neighborhood of and along the course of the chief venous trunks. It may begin in the groin or hip, and extend downwards; or it may commence in the calf, and proceed upwards towards the pelvis. The pain abates somewhat after swelling of the limb (which generally begins within twenty-four hours), but it is always a distressing symptom, and continues as long as the acute stage of the disease lasts. The restlessness, want of sleep, and suffering which it produces are sometimes excessive. Coincident with the pain, and sometimes preceding it, more or less malaise is experienced. The patient may for a day or two be restless, irritable, and out of sorts, without any very definite cause; or the disease may be ushered in by a distinct rigor. Generally there is constitutional disturbance, varying with the intensity of the case. The pulse is rapid and weak, 120 or thereabouts; the temperature elevated, from 101° to 102°, with an evening exacerbation. The patient is thirsty; the tongue glazed, or white and loaded; the bowels constipated. In some few cases, when the local affection is slight, none of these constitutional symptoms are observed.

The characteristic swelling rapidly follows the commencement of the symptoms. It generally begins in the groin, from whence it extends downwards. It may be limited to the thigh, or the whole limb, even to the feet, may be implicated. More rarely it commences in the calf of the leg, extending upwards to the thigh and downwards to the feet. The affected parts have a peculiar appearance, which is pathognomonic of the disease. They are hard, tense, and brawny, of a shiny, white color, and not yielding on pressure, except towards the beginning and end of the illness. The appearances presented are quite different from those of ordinary œdema. When the whole thigh is affected, the limb is enormously increased in size. Frequently the venous trunks, especially the femoral and popliteal veins, are felt obstructed with coagula, and rolling under the finger. They are painful when handled, and in their course more or less redness is occasionally observed. Either leg may be attacked, but the left more frequently than the right. There is a marked tendency for the disease to spread to the sound limb, and we often find, in a case which is progressing apparently well, a rise of temperature and an accession of febrile symptoms, followed by the swelling of the other limb.

Progress of the Disease.—After the acute stage has lasted from a week to a fortnight, the constitutional disturbance becomes less marked the pulse and temperature fall, the pain abates, and the sleeple and restlessness are less. The swelling and tension of the limb now begin to diminish, and absorption commences. This is invariably a slow process. It is always many weeks before the effusion has disappeared, and it may be many months. The limb retains for a length of time the peculiar *wooden* feeling, as Dr. Churchill terms it. Any imprudence, such as a too early attempt at walking, may bring on a relapse and fresh swelling of the limb. This gradual recovery is by far the most common termination of the disease. In some rare cases suppuration may take place, either in the subcutaneous cellular tissue, the lymphatic glands, or even in the joints, and death may result from exhaustion. The possibility of pulmonary obstruction and sudden death from separation of an embolus has already been pointed out, and the fact that this lamentable occurrence has generally followed some undue exertion should be borne in mind, as a guide in the management of our patient.

Period of Commencement.—The disease usually begins within a short time after delivery, rarely after the second week. In 22 cases tabulated by Dr. Robert Lee, 7 were attacked between the fourth and twelfth days, and 14 after the second week. Some cases have been described as commencing even months after delivery. It is questionable if these can be classed as puerperal, for it must not be forgotten that phlegmasia dolens is by no means necessarily a puerperal disease. There are many other conditions which may give rise to it, all of them, however, such as produce a septic and hyperinosed state of the blood, such as malignant disease, dysentery, phthisis, and the like. My own experience would lead me to think that cases of this kind are much more common than is generally believed.

History and Pathology.—The disease has long attracted the attention of the profession. Passing over more or less obscure notices by Hippocrates, De Castro, and others, we find the first clear account in the writings of Mauriceau, who not only gave a very accurate description of its symptoms, but made a guess at its pathology which was certainly more happy than the speculations of his successors: it is, he says, caused "by a reflux on the parts of certain humors which ought to have been evacuated by the lochia." Puzos ascribed it to the arrest of the secretion of milk, and its extravasation in the affected limb. This theory, adopted by Levret and many subsequent writers, took a strong hold on both professional and public opinion, and to it we owe many of the names by which the disease is known to this day, such as œdema lacteum, milk leg, &c. In 1784, Mr. White, of Manchester, attributed it to some morbid condition of the lymphatic glands and vessels of the affected parts; and this, or some analogous theory, such as that of rupture of the lymphatics crossing the pelvic brim, as maintained by Trye, of Gloucester, or general inflammation of the absorbents, as held by Dr. Ferriar, was generally adopted.

It was not until the year 1823 that attention was drawn to the condition of the veins. To Bouillaud belongs the undoubted merit of first pointing out that the veins of the affected limb were blocked up by coagula, although the fact had been previously observed by Dr. Davis, of University College. Dr. Davis made dissections of the veins in a fatal case, and found, as Bouillaud had done, that they were filled with coagula, which he assumed to be the results of inflammation of their coats; hence the name of "*crural phlebitis*," which has been extensively adopted instead of phlegmasia dolens. Dr. Robert Lee did much to favor this view, and, finding that thrombi were present in the iliac and uterine, as well as in the femoral, veins, he concluded that the phlebitis commenced in the uterine branches of the hypogastric veins and extended downwards to the femorals. He pointed out that phlegmasia dolens was not limited to the puerperal state; but that when it did occur independently of it, other causes of uterine phlebitis were present, such as cancer of the os and cervix uteri. The inflammatory theory was pretty generally received, and even now is considered by many to be a sufficient explanation of the disease. Indeed, the fact that more or less thrombus was always present could not be denied, and on the supposition that thrombus could only be caused by phlebitis, as was long supposed to be the case, the inflammatory theory was the natural one. Before long, however, pathologists pointed out that thrombosis was by no means necessarily, or even generally, the result of inflammation of the vessels in which the clot was contained, but that the inflammation was more generally the result of the coagulum.

The late Dr. Mackenzie took a prominent part in opposing the phlebitic theory. He proved, by numerous experiments in the lower animals, that inflammation is not sufficient of itself to produce the extensive thrombi which are found to exist, and that inflammation originating in one part of a vein is not apt to spread along its canal, as the phlebitic theory assumes. His conclusion is, that the origin of the disease is rather to be sought in some septic or altered condition of the blood, producing coagulation in the veins. Dr. Tyler Smith[1] pointed out an occasional analogy between the causes of phlegmasia dolens and puerperal fever, evidently recognizing the dependence of the former on blood dyscrasia. "I believe," he says, "that contagion and infection play a very important part in the production of the disease. I look on a woman attacked with phlegmasia dolens as having made a fortunate escape from the greater dangers of diffuse phlebitis or puerperal fever." In illustration of this he narrates the following instructive history. "A short time ago a friend of mine had been in close attendance on a patient dying of erysipelatous sore throat with sloughing, and was himself affected with sore throat. Under these circumstances, he attended, within the space of twenty-four hours, three ladies in their confinements, all of whom were attacked with phlegmasia dolens."

The latest important contribution to the pathology of the disease is contained in two papers by Dr. Tilbury Fox, published in the second volume of the "Obstetrical Transactions." He maintains that something beyond the mere presence of coagula in the veins is required to produce the phenomena of the disease, although he admits that to be an important, and even an essential, part of the pathological changes present. The thrombi he believes to be produced either by extrinsic or intrinsic causes: the former comprising all cases of pressure by tumor or the like; the latter, and the most important, being divisible into the heads of—

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[1] Tyler Smith, Manual of Obstetrics, p. 538.

1. True inflammatory changes in the vessels, as seen in the epidemic form of the disease.
2. Simple thrombus, produced by rapid absorption of morbid fluid.
3. Virus action and thrombus conjoined, the phlegmasia dolens itself being the result of simple thrombus, and not produced by diseased (inflamed) coats of vessels; the general symptoms the result of the general blood state; the virus present.

He further points out that the peculiar swelling of the limbs cannot be explained by the mere presence of œdema, from which it is essentially different,—the white appearance of the skin, the severe neuralgic pain, and the persistent numbness, indicating that the whole of the cutaneous textures, the cutis vera, and even the epithelial layer, are infiltrated with fibrinous deposit. He concludes, therefore, that the swelling is the result of œdema *plus* something else; that something being obstruction of the lymphatics, by which the absorption of effused serum is prevented. The efficient cause which produces these changes he believes to be, in the majority of cases, a septic action originating in the uterus, producing a condition similar to that in which phlegmasia dolens arises in the non-puerperal state.

There is no doubt much force in Dr. Fox's arguments, and it may, I think, be conceded that obstruction of the veins *per se* is not sufficient to produce the peculiar appearance of the limb. It is, moreover, certain that phlebitis alone is also an insufficient explanation not only of the symptoms, but even of the presence of thrombi so extensive as those that are found. The view which traces the disease solely to inflammation or obstruction of lymphatics is purely theoretical, has no basis of facts to support it, and finds, nowadays, no supporters. The experiments of Mackenzie and Lee, as well as the vastly increased knowledge of the causes of thrombosis which the researches of modern pathologists have given us, seem to point strongly to the view already stated, that the disease can only be explained by a general blood dyscrasia, depending on the puerperal state. It by no means follows that we are to discard Dr. Fox's speculations as incorrect. It is far from improbable that the lymphatic vessels are implicated in the production of the peculiar swelling, only we are not as yet in a position to prove it. There is no inherent improbability in the supposition that the same morbid state of the blood which produces thrombosis in the veins may also give rise to such an amount of irritation in the lymphatics as may interfere with their functions, and even obstruct them altogether. The essential and all-important point in the pathology of the disease, however, seems undoubtedly to be thrombosis in the veins; and the probability of there being some as yet undetermined pathological changes in addition to this, by no means militates against the view I have taken of the intimate connection of the disease with other results of thrombosis in more distant vessels.

The changes which take place in the thrombi all tend to their ultimate absorption. These have been described by various authors as leading to organization or suppuration. It is probable, however, that the appearances which have led to such a supposition are fallacious, and that they are really due to retrograde metamorphosis of the fibrine, generally of an amylaceous or fatty character.

Detachment of Emboli.—The peculiarities of a clot that most favor detachment of an embolus are such a shape as admits of a portion floating freely in the blood-current, by the force of which it is detached and carried to its ultimate destination. When the accident has occurred, it is often possible to recognize the peripheral thrombus from which the embolus has separated, by the fact of its terminal extremity presenting a freshly fractured end, instead of the rounded head natural to it. Such detachment is unlikely to occur, even when favored by the shape of the clot, unless sufficient time have elapsed after its formation to admit of its softening and becoming brittle. The curious fact I have before mentioned, of true puerperal embolism occurring, in the large majority of cases, only after the nineteenth day from delivery, finds a ready explanation in this theory, which it remarkably corroborates.

Treatment.—On the supposition that phlegmasia dolens was the result of inflammation of the veins of the affected limb, an antiphlogistic course of treatment was naturally adopted. Accordingly, most writers on the subject recommend depletion, generally by the application of leeches along the course of the affected vessels. We are told that if the pain continue the leeches should be applied a second, or even a third, time. If we admit the septic origin of the disease we must, I think, see the impropriety of such a practice. The fact that it occurs, in a large majority of cases, in patients of a weakly and debilitated constitution, often in women who have already suffered from hemorrhage, is a further reason for not adopting this routine custom. If local loss of blood be used at all, it should be strictly limited to cases in which there is much tenderness and redness along the course of the veins, and then only in patients of plethoric habit and strong constitution; cases of this kind will form a very small minority of those coming under our observation.

What has been said of the pathology of the affection tends to the conclusion that active treatment of any kind, in the hope of curing the disease, is likely to be useless. Our chief reliance must be on time and perfect rest, in order to admit of the thrombi and the secondary effusion being absorbed; while we relieve the pain and other prominent symptoms, and support the strength and improve the constitution of the patient.

The constant application of heat and moisture to the affected limb will do much to lessen the tension and pain. Wrapping the entire limb in linseed-meal poultices, frequently changed, is one of the best means of meeting this indication. If, as is sometimes the case, the weight of the poultices be too great to be readily borne, we may substitute warm flannel stupes, covered with oil silk. Local anodyne applications afford much relief, and may be advantageously used along with the poultices and stupes, either by sprinkling their surface freely with laudanum, or chloroform and belladonna liniment, or by soaking the flannels in poppy-head fomentation. It is needless to say that the most absolute rest in bed should be enjoined, even in slight cases, and that the limb should be effectually guarded from undue pressure by a cradle or some similar contrivance. Local counter-irritation has been strongly recommended, and frequent blisters have been considered by some to be almost specific. I should myself hesitate to use blisters, as they would certainly not be soothing applications, and one hardly sees how they can be of much service in hastening the absorption of the effusion.

Constitutional Treatment.—During the acute stage of the disease the constitutional treatment must be regulated by the condition of the patient. Light but nutritious diet must be administered in abundance, such as milk, beef-tea, and soups. Should there be much debility, stimulants in moderation may prove of service. With regard to medicines, we will probably find benefit from such as are calculated to improve the condition of the blood and the general health of the patient. Chlorate of potash, with dilute hydrochloric acid, quinine, either alone or in combination with sesquicarbonate of ammonia, the tincture of the perchloride of iron, are the drugs that are most likely to prove of service. Alkalies and other medicines, which have been recommended in the hope of hastening the absorption of coagula, must be considered as altogether useless. Pain must be relieved by the judicious use of anodynes, such as Dover's powder at bedtime, the subcutaneous injection of morphia, or chloral to produce sleep. Generally no form answers so well as the hypodermic injection of morphia.

Subsequent Local Treatment.—When the acute symptoms have abated, and the temperature has fallen, the poultices and stupes may be discontinued, and the limb swathed in a flannel roller from the toes upwards. The equable pressure and support thus afforded materially aid the absorption of the effusion, and tend to diminish the size of the limb. At a still later stage very gentle inunctions of weak iodine ointment may be used with advantage once a day before the roller is applied. Shampooing and friction of the limb, generally recommended for the purpose of hastening absorption, should be carefully avoided, on account of the possible risk of detaching a portion of the coagulum, and producing embolism. This is no merely imaginary danger, as the following fact narrated by Trousseau proves. "A phlegmasia alba dolens had appeared on the left side in a young woman suffering from periuterine phlegmon. The pain having ceased, a thickened venous trunk was felt on the upper and internal part of the thigh. Rather strong pressure was being made, when M. Demarquay felt something yield under his fingers. A few minutes afterwards the patient was attacked with dreadful palpitation, tumultuous cardiac action, and extreme pallor, and death was believed to be imminent. After some hours, however, the oppression ceased; and the patient eventually recovered. A slightly attached coagulum must have become separated, and conveyed to the heart or pulmonary artery."[1] Warm douches of water, of salt water if it can be obtained, may be advantageously used in the later stages of the disease, and they may be applied night and morning, the limb being bandaged in the interval. The occasional use of the electric current is said to promote absorption, and would seem likely to be a serviceable remedy.

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[1] Trousseau, Clinique de l'Hôtel-Dieu, in Gaz. des Hôp., 1860, p. 577.

When the patient is well enough to be moved, a change of air to the seaside will be of value. Great caution, however, should be recommended in using the limb, and it is far better not to run the risk of a relapse by any undue haste in this respect. It is well to warn the patient and her friends that a considerable time must of necessity elapse before the local signs of the disease have completely disappeared.

CHAPTER X.

PELVIC CELLULITIS AND PELVIC PERITONITIS.

From the earliest time the occurrence after parturition of severe forms of inflammatory disease in and about the pelvis, frequently ending in suppuration, has been well known. It is only of late years, however, that these diseases have been made the subject of accurate clinical and pathological investigation, and that their true nature has begun to be understood. Nor is our knowledge of them as yet by any means complete. They merit careful study on the part of the accoucheur, for they give rise to some of the most severe and protracted illnesses from which puerperal patients suffer. They are often obscure in their origin and apt to be overlooked, and they not rarely leave behind them lasting mischief.

These diseases are not limited to the puerperal state. On the contrary, many of the severest cases arise from causes altogether unconnected with child-bearing. These will not be now considered; and this chapter deals solely with such forms as may be directly traced to childbirth.

Recent researches have demonstrated that there are two distinct varieties of inflammatory disease met with after labor, which differ materially from each other in many respects. In one of these the inflammation affects chiefly the connective tissue surrounding the generative organs contained within the pelvis, or extends up from it beneath the peritoneum, and into the iliac fossæ. In the other it attacks that portion of the peritoneum which covers the pelvic viscera, and is limited to it.

So much is admitted by all writers; but great obscurity in description, and consequent difficulty in understanding satisfactorily the nature of these affections, have resulted from the variety of nomenclature which different authors have adopted.

Thus, the former disease has been variously des vic cellulitis, peri-uterine phlegmon, parametritis, or hile the latter is not unfrequently called perimetritis, as contradistinguished from parametritis. The use of the prefix *para* or *peri*, to distinguish the cellular or peritoneal variety of inflammation, originally suggested by Virchow, has been pretty generally adopted in Germany, and has been strongly advocated in this country by Matthews Duncan. It has never, however, found much favor with English writers, and the similarity of the two names is so great as to lead to confusion. I have, therefore, selected the terms "*pelvic peritonitis*" and "*pelvic cellulitis*," as conveying in themselves a fairly accurate notion of the tissues mainly involved.

The important fact to remember is that there exist two distinct varieties of inflammatory disease, presenting many similarities in their course, symptoms, and results, often occurring simultaneously, but in the main distinct in their pathology, and capable of being differentiated. Thomas compares them—and, as serving to fix the facts on the memory, the illustration is a good one—to pleurisy and pneumonia. "Like them," he says, "they are separate and distinct, like them affect different kinds of structure, and like them they generally complicate each other." It might, therefore, be advisable, as most writers on the disease occurring in the non-puerperal state have done, to treat of them in two separate chapters. There is, however, more difficulty in distinguishing them as puerperal than as non-puerperal affections, for which reason, as well as for the sake of brevity, I think it better to consider them together, pointing out, as I proceed, the distinctive peculiarities of each.

Seat of Disease.—When attention was first directed to this class of disease, the pelvic cellular tissue was believed to be the only structure affected. This was the view maintained by Nonat, Simpson, and many modern writers. The attention of the profession was first prominently directed to the importance of localized inflammation of the peritoneum, and to the fact that many of the supposed cases of cellulitis were really peritonitic, by Bernutz. There can be no doubt that he here made an enormous step in advance. Like many authors, however, he rode his hobby a little too hard, and he erred in denying the occurrence of cellulitis in many cases in which it undoubtedly exists.

Etiology.—The great influence of child-birth in producing these diseases has long been fully recognized. Courty estimates that about two-thirds of all the cases met with occur in connection with delivery or abortion, and Duncan found that out of 40 carefully observed cases, 25 were associated with the puerperal state.

It is pretty generally admitted by most modern writers that both varieties of the disease are produced by the extension of inflammation from either the uterus, the Fallopian tubes, or the ovaries. This point has been especially insisted on by Duncan, who maintains that the disease is never idiopathic, and is "invariably secondary either to mechanical injury or to the extension of inflammation of some of the pelvic viscera, or to the irritation of the noxious discharges through or from the tubes or ovaries."

Their intimate connection with puerperal septicæmia is also a prominent fact in the natural history of the diseases. Barker mentions a curious observation illustrative of this, that when puerperal fever is endemic in the Bellevue Hospital in New York, cases of pelvic peritonitis and cellulitis are also invariably met with. As inflammation of the lining membrane of the uterus, of the vaginal mucous membrane, and of the pelvic connective tissue, are of very constant occurrence as local phenomena of septic absorption, the connection between the two classes of cases is readily susceptible of explanation. Schroeder, indeed, goes further, and includes his description of these diseases under the head of puerperal fever. They do not, however, necessarily depend upon it; for, although it must be admitted that cases of this kind form a large proportion of those met with, others unquestionably occur which cannot be traced to such sources, but are the direct result of causes altogether unconnected with the inflammation attending on septic absorption, such as undue exertion shortly after delivery, or premature coition. Mechanical causes may beyond doubt excite the disease in a woman predisposed by the puerperal process, but they cannot fairly be included under the head of puerperal fever.

Abundance of areolar tissue exists in connection with the pelvic viscera, which may be the seat of cellulitis. It forms a loose padding between the organs contained in the pelvis proper, surrounds the vagina, the rectum, and the bladder, and is found in considerable quantity between the folds of the broad ligaments. From these parts it extends upwards to the iliac fossæ, and the inner surface of the abdominal parietes. In any of these positions it may be the seat of the kind of inflammation we are discussing. The essential character of the inflammation is similar to that which accompanies areolar inflammation in other parts of the body. There is first an acute inflammatory œdema, followed by the infiltration of the areolæ of the connective tissue with exudation, and the consequent formation of appreciable swellings. These may form in any part of the pelvis. Thus, we may meet with them, and this is a very common situation, between the folds of the broad ligaments, forming distinct hard tumors, connected with the uterus, and extending to the pelvic walls, their rounded outlines being readily made out by bi-manual examination. If the cellulitis be limited in extent, such a swelling may exist on one side of the uterus only, forming a rounded mass of varying size, and apparently attached to it. At other times the exudation is more extensive, and may completely or partially surround the uterus, extending to the cellular tissue between the vagina and rectum, or between the uterus and the bladder. In such cases the uterus is imbedded and firmly fixed in dense, hard exudation. At other times the inflammation chiefly affects the cellular tissue covering the muscles lining the iliac fossæ. There it forms a mass, easily made out by palpation, but on vaginal examination little or no trace of the exudation can be felt, or only a sense of thickness at the roof of the vagina on the same side as the swelling.

In pelvic peritonitis the inflammation is limited to that portion of the peritoneum which invests the pelvic viscera. Its extent necessarily varies with the intensity and duration of the attack. In some cases there may be little more than irritation, while more often it runs on to exudation of plastic material. The result is generally complete fixation of the uterus, and hardening and swelling i [illegible] a, and the lymph poured out may mat together the surrounding viscera, so as to form swellings, difficult, in some cases, to differentiate from those resulting from cellulitis. On post-mortem examination the pelvic viscera are found extensively adherent, and the agglutination may involve the coils of the intestine in the vicinity, so as sometimes to form tumors of considerable size.

The relative frequency of these two forms of inflammation as puerperal affections is not easy to ascertain. In the non-puerperal state the peritonitic variety is much the more common, but in the puerperal state this is not so sure. They very generally complicate each other, and it is rare for cellulitis to exist to any great extent without more or less peritonitis.

Symptomatology.—The earliest symptom is pain in the lower part of the abdomen, which is generally preceded by rigor or chilliness. The amount of pain varies much. Sometimes it is comparatively slight, and it is by no means rare to meet with patients, who are the subjects of very considerable exudations, who suffer little more than a certain sense of weight and discomfort at the lower part of the abdomen. On the other hand, the suffering may be excessive, and is characterized by paroxysmal exacerbations, the patient being comparatively free from pain for several successive hours, and then having attacks of the most acute agony. Schroeder says that pain is always a symptom of peritonitis, and that it does not exist in uncomplicated cellulitis. The swellings of cellulitis are certainly sometimes remarkably free from tenderness, and I have often seen masses of exudation in the iliac fossæ, which could bear even rough handling. On the other hand, although this is certainly more often met with in non-puerperal cases, the tenderness over the abdomen is sometimes excessive, the patient shrinking from the slightest touch. The pulse is raised, generally from 100 to 120, and the thermometer shows the presence of pyrexia. During the entire course of the disease both these symptoms continue. The temperature is often very high, but more frequently it varies from 100° to 104°, and it generally shows more or less marked remissions. In some cases the temperature is said not to be elevated at all, or even to be subnormal, but this is certainly quite exceptional. Other signs of local and general irritation often exist. Among them, and most distinctly in cases of peritonitis, are nausea and vomiting, and an anxious pinched expression of the countenance, while the local mischief often causes distressing dysuria and tenesmus. The latter is especially apt to occur when there is exudation between the rectum and vagina, which presses on the bowel. The passage of fæces, unless in a very liquid form, may then cause intolerable suffering.

Such symptoms may show themselves within a few days after delivery, and then they can hardly fail to attract attention. On the other hand, they may not commence for some weeks after labor, and then they are often insidious in their onset, and apt to be overlooked. It is far from rare to meet with cases six weeks or more after confinement, in which the patient complains of little beyond a feeling of malaise and discomfort, in which, on investigation, a considerable amount of exudation is detected which had previously entirely escaped observation.

Results of Physical Examination.—On introducing the finger into the vagina it will be found to be hot and swollen, in some cases distinctly œdematous, and on reaching the vaginal cul-de-sacs the existence of exudation may generally be made out. The amount of this varies much. Sometimes, especially in the early stage of the disease, there is little more than a diffuse sense of thickness and induration at either side of, or behind, the uterus. More generally careful bi-manual examination enables us to detect a distinct hardening and swelling, possibly a tumor of considerable size, which may apparently be attached to the sides of the uterus, and rise above the pelvic brim, or may extend quite to the pelvic walls. The examination should be very carefully and systematically conducted with both hands, so as to explore the whole contour of the uterus before, behind, and on either side, as well as the iliac fossæ; otherwise a considerable exudation might readily escape detection. When the exudation is at all great, more or less fixity of the uterus is sure to exist, and is a very characteristic symptom. The womb, instead of being freely movable by the examining finger, is firmly fixed by the surrounding exudation, and in severe forms of the disease is quite encased in it. More or less displacement of the organ is also of common occurrence. If the swelling be limited to one side of the pelvis or to Douglas's space, the uterus is displaced in the opposite direction, so that it is no longer in its usual central position.

The differential diagnosis of pelvic cellulitis and pelvic peritonitis cannot always be made, and, indeed, in many cases it is impossible, since both varieties of disease co-exist. The elements of differentiation generally insisted on are, the greater general disturbance, nausea, &c., in pelvic peritonitis, with an earlier commencement of the symptoms after labor. The swellings of pelvic peritonitis are also more tender, with less clearly-defined outline, than those of cellulitis. When the cellulitis involves the iliac fossa the diagnosis is, of course, easy, and then a continuous retraction of the thigh on the affected side (an involuntary position assumed with the view of keeping the muscles lining the iliac fossa at rest) is often observed. When the inflammation is chiefly limited to the cavity of the pelvis, the distinction between the two classes of cases cannot be made with any degree of certainty.

Terminations.—Both forms of disease may end either in resolution or in suppuration. In the former case, after the acute symptoms have existed for a variable time, it may be for a few days only, it may be for many weeks, their severity abates, the swellings become less tender and commence to contract, become harder, and are gradually absorbed; until, at last, the fixity of the uterus disappears, and it again resumes its central position in the pelvic cavity. This process is often very gradual. It is by no means rare to find a patient, even some months after the attack, when all acute symptoms have long disappeared, who is even able to move about without inconvenience, in whom the uterus is still immovably fixed in a mass of deposit, or is, at least, adherent in some part of its contour. More or less permanent adhesions are of common occurrence, and give rise to symptoms of considerable obscurity, which are often not traced to their proper source.

Symptoms of Suppuration.—When the inflammation is about to terminate in suppuration, the pyrexial symptoms continue, and eventually well-marked hectic is developed, the temperature generally showing a distinct exacerbation at night. At the same time rigors, loss of appetite, a peculiar yellowish discoloration of the face, and other signs of suppuration, show themselves. The relative frequency of this termination is variously estimated by authors. Duncan quotes Simpson as calculating it as occurring in half the cases of pelvic cellulitis, but states his own belief that it is much more frequent. West observed it in 23 out of 43 cases following delivery or abortion, and McClintock in 37 out of 70. Schroeder says that he has only once seen suppuration in 92 cases of distinctly demonstrable exudation, a result which is certainly totally opposed to common experience. Barker also states that in his experience suppuration in either pelvic peritonitis or cellulitis "is very rare, except when they are associated with pyæmia or puerperal fever." It is certain that suppuration is more likely to occur in pelvic cellulitis than in pelvic peritonitis, but it unquestionably occurs, in this country at least, much more frequently than the statements of either of these authors would lead us to suppose.

The pus may find an exit through various channels. In pelvic cellulitis, more especially when the areolar tissue of the iliac fossa is implicated, the most common site of exit is through the abdominal wall. It may, however, open at other positions, and the pus may find its way through the cellular tissue and point at the side of the anus, or in the vagina, or it may take even a more tortuous course and reach the inner surface of the thigh. Pelvic abscesses not uncommonly open into the rectum or bladder, causing very considerable distress from tenesmus or dysuria. According to Hervieux, it is chiefly the peritoneal varieties which open in this way. Not unfrequently more than one opening is formed; and when the pus has burrowed for any distance, long fistulous tracts result, which secrete pus for a length of time, and are very slow to heal. Rupture of an abscess into the peritoneal cavity, especially of a peritonitic abscess, is a possible (but fortunately a very rare) termination, and will generally prove fatal by producing general peritonitis. In one case which I have recorded in the fifteenth volume of the "Obstetrical Transactions," suppuration was followed by extensive necrosis of the pelvic bones. Two similar cases are related by Trousseau in his "Clinical Medicine;" but I have not been able to meet with any other examples of this rare complication, which was probably rather the result of some obscure septicæmic condition than of extension of the inflammation.

The *prognosis* is favorable as regards ultimate recovery, but there is great risk of a protracted illness which may seriously impair the health of the patient, especially if suppuration result. Hence it is necessary to be guarded in an expression of opinion as to the consequences of the disease. Secondary mischief is also far from unlikely to follow, from the physical changes produced by the exudation, such as permanent adhesions or malpositions of the uterus, or organic alterations in the ovaries or Fallopian tubes.

Treatment.—In the treatment of both forms of disease the important indications to bear in mind are the relief of pain and the necessity of absolute rest; and to these objects all our measures must be subordinate, since it is quite hopeless to attempt to cut short the inflammation by any active medication.

If the disease be recognized at a very early stage, the local abstraction of blood, by the application of a few leeches to the groin or to the hemorrhoidal veins, may give relief; but the influence of this remedy has been greatly exaggerated, and when the disease is of any standing it is quite useless. Leeches to the uterus, often recommended, are, I believe, likely to do more harm than good (unless in very skilful hands), from the irritation produced by passing the speculum. Opiates in large doses may be said to be our sheet-anchor in treatment whenever the pain is at all severe, either by the mouth, in the form of morphia suppositories, or injected subcutaneously. In the not uncommon cases in which pain comes on severely in paroxysms, the opiates should be administered in sufficient quantity to lull the pain, and it is a good plan to give the nurse a supply of morphia suppositories (which often act better than any other form of administering the drug), with directions to use them immediately the pain threatens to come on. When there is much pyrexia, large doses of quinine may be given with great advantage, along with the opiates. The state of the bowels requires careful attention. The opiates are apt to produce constipation, and the passage of hardened fæces causes much suffering. Hence it is desirable to keep the bowels freely open. Nothing answers this purpose so well as small doses of castor-oil, such as half a teaspoonful given every morning. Warmth and moisture constantly applied to the lower part of the abdomen give great relief, either in the form of large poultices of linseed meal, or, if these prove too heavy, of spongio-piline soaked in boiling water. The poultices may be advantageously sprinkled with laudanum or belladonna liniment. I say nothing of the use of mercurials, iodide of potassium, and other so-called absorbent remedies, since I believe them to be quite valueless, and apt to divert attention from more useful plans of treatment.

Importance of Rest.—The most absolute rest in the recumbent position is essential, and it should be persevered in for some time after the intensity of the symptoms is lessened. The beneficial effect of rest in alleviating pain is often seen in neglected cases, the nature of which has been overlooked, instant relief following the laying up of the patient.

Counter-Irritation.—When the acute symptoms have lessened, absorption of the exudation may be favored, and considerable relief obtained, from counter-irritation, which should be gentle and long-continued. The daily use of tincture of iodine until the skin peels, perhaps best meets this indication; but frequently-repeated fly blisters are often very serviceable. This I believe to be a better plan than keeping up an open sore with savine ointment or similar irritating applications.

Opening of Pelvic Abscesses.—When suppuration is established, the question of opening the abscess arises. When this points in the groin, and the matter is superficial, a free incision may be made; and here, as in mammary abscess, the antiseptic treatment is likely to prove very serviceable. The abscess should, however, not be opened too soon, and it is better to wait until the pus is near the surface. The importance of not being in too great a hurry to open pelvic abscesses has been insisted on by West, Duncan, and other writers, and I have no doubt the rule is a good one. It is more especially applicable when the abscess is pointing in the vagina or rectum, where exploratory incisions are apt to be dangerous, and when the presence of pus should be positively ascertained before operating. We have in the aspirator a most useful instrument in the treatment of such cases, which enables us to remove the greater part of the pus without any risk, and the use of which is not attended with danger, even if employed prematurely. If it do not sufficiently evacuate the abscess, a free opening can afterwards be safely made with the bistoury. The surgical treatment of pelvic abscess is, however, too wide a subject to admit of being satisfactorily treated here.

Diet and Regimen.—The diet should be abundant, but simple and nutritious. In the early stages of the disease, milk, beef-tea, eggs, and the like, will be sufficient. After suppuration, a large quantity of animal food is required, and a sufficient amount of stimulant. The drain on the system is then often very great, and the amount of nourishment patients will require and assimilate, when a copious purulent discharge is going on, is often quite remarkable. A general tonic plan of medication will also be required, and such drugs as iron, quinine, and cod-liver oil will prove useful.

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